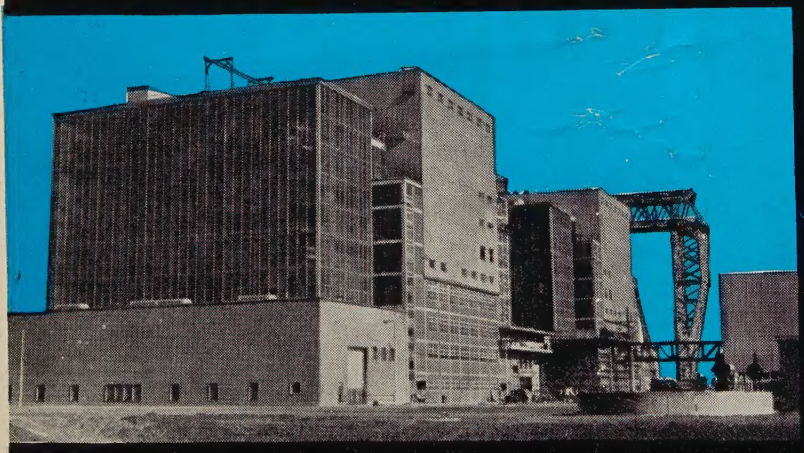
ELECTRICAL REVIEW

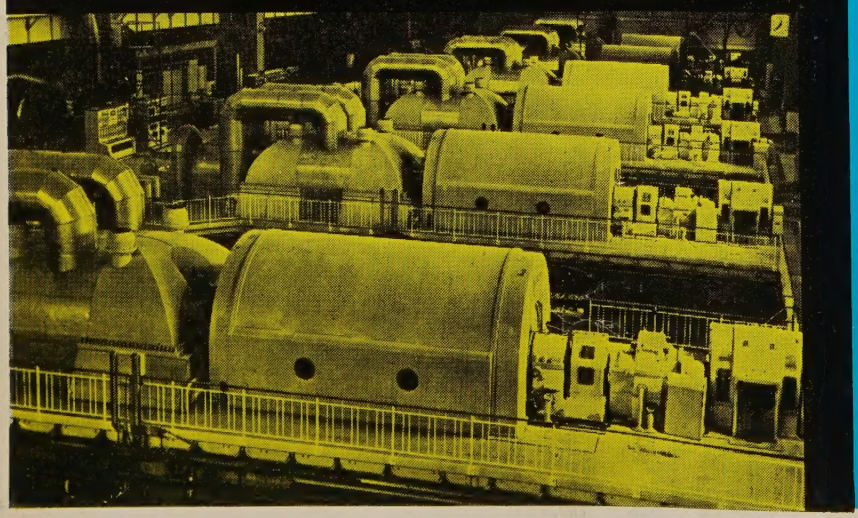
FRIDAY
DECEMBER 1961

WEEKLY
PRICE 1s 6d

ELECTRICAL INSULATION

for Nuclear Power Stations





The first two C.E.G.B. Nuclear Power Stations both make extensive use of M&I insulation; in the electrical plant supplied by A E I to Berkeley and by C. A. Parsons & Co. Ltd., to Bradwell. Amongst the various types of insulation supplied are "Paxolin" tubes, transformer cylinders and fabric based material as well as Micanite in various forms including V-rings.

As the manufacturers of the most extensive range of electrical insulating materials in this country M & I naturally have a wide experience of insulation problems on every type of power generation and distribution system.

m and i

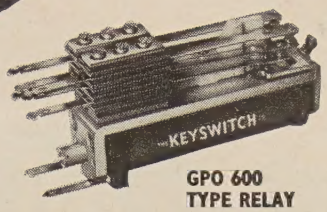
the electrical insulation people

THE MICANITE & INSULATORS CO., LTD.,
Walthamstow, London, E.17.
Tel: Larkswood 5500.
Grams: Mytilite, London, Telex. Telex 25183

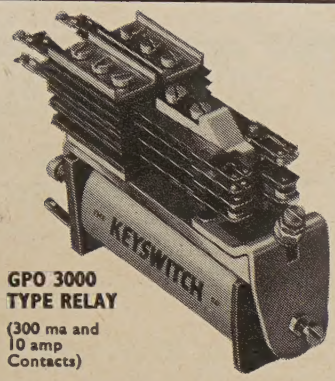
Photographs by courtesy of The Nuclear Power Group.
Bottom picture shows the six Parsons 52MW turbo-generators in which M & I Micanite V-rings have been used.

RELAYS

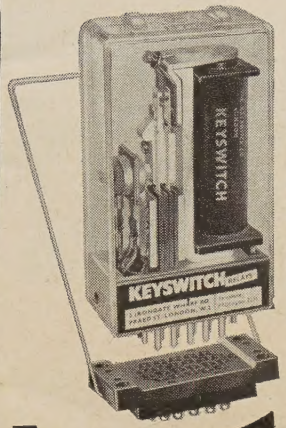
GPO RELAYS
WE'VE GOT OUR FINGER OUT!
ALL ORDERS OF UP TO 1,000 PER WEEK
2 TO 4 WEEKS DELIVERY



GPO 600 TYPE RELAY
(Minor)

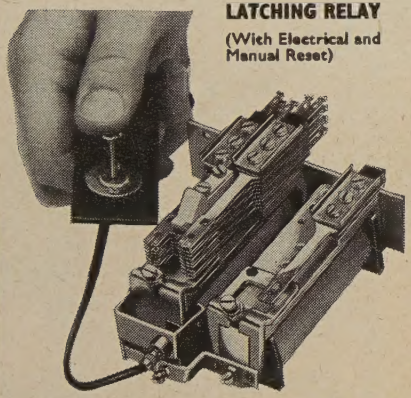


GPO 3000 TYPE RELAY
(300 ma and 10 amp Contacts)



PLUG IN GPO 3000 TYPE RELAY
(Transparent Cover and base)

KEYSWITCH RELAYS



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SILENT A.C. RELAY CONTACTOR
(Switching 30 amps)
(240 volts A.C.)

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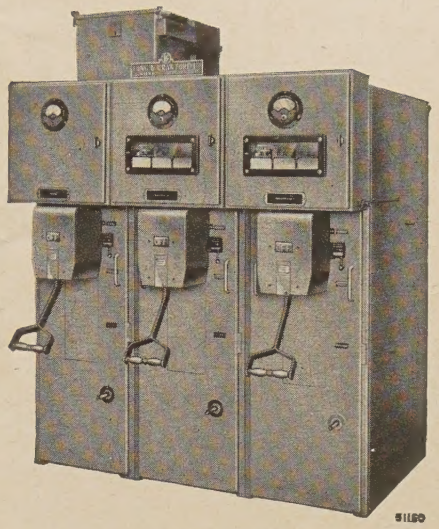
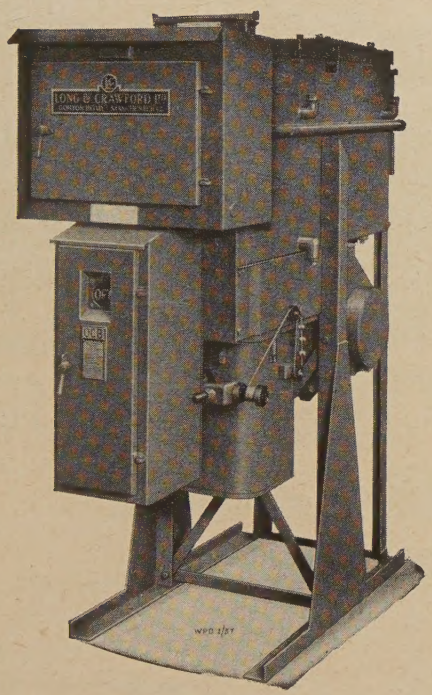
Extremely advantageous quotations and delivery can be offered for quantity orders.

CIRCUIT BREAKERS



INDOOR UNITS

ALD range of indoor vertical isolation air-insulated Circuit Breaker Units. Current rating up to 1,200 amps. Rated breaking capacities up to 350 MVA at 11 kV, 250 MVA at 6.6 kV and 150 MVA at 3.3 kV. Fitted with Hand, Spring or solenoid power-closing mechanism.

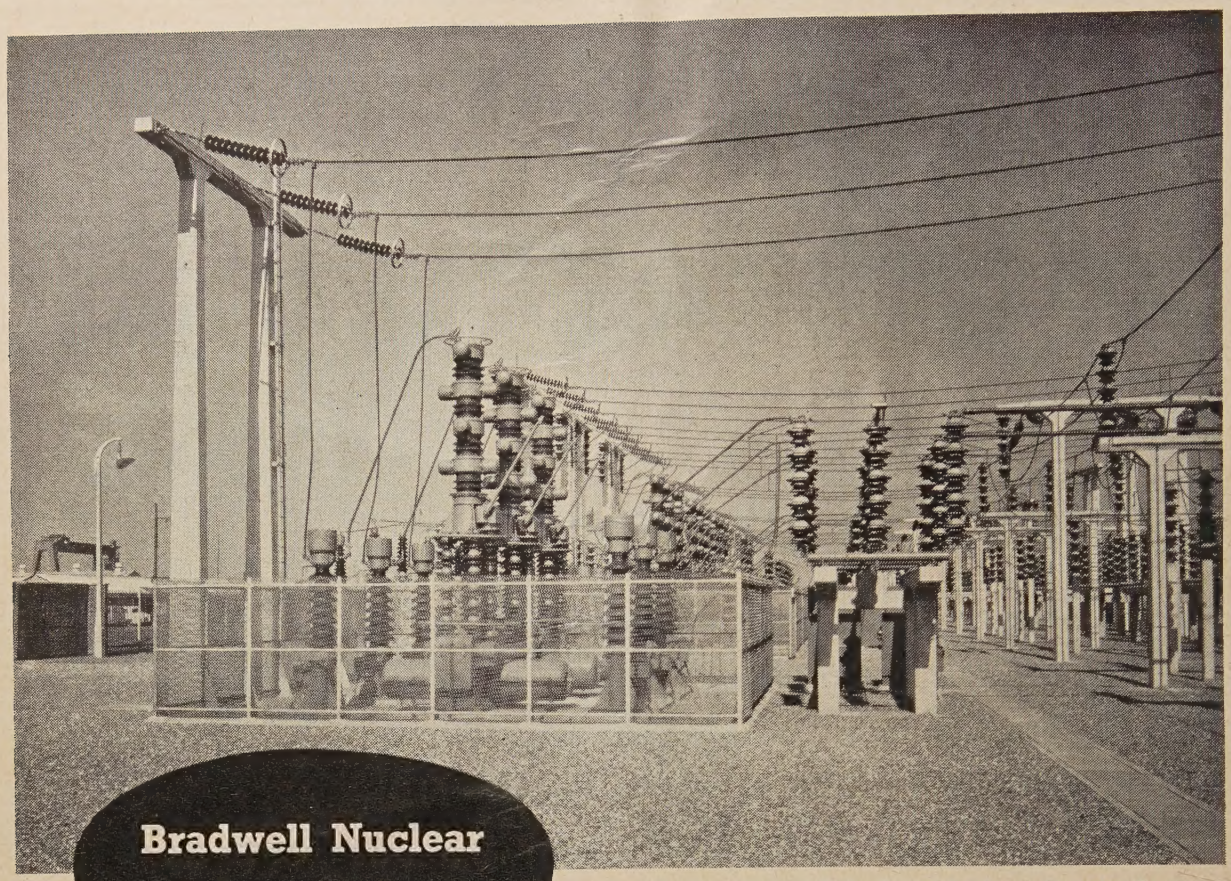


OUTDOOR UNITS

WPD range of outdoor oil and compound filled Circuit Breaker Units. Current ratings 400/800 amps. Tested fault ratings: 350 MVA at 11 kV and 250 MVA at 6.6 kV. Spring, Hand or solenoid mechanisms.

LONG & CRAWFORD LTD.

GORTON ROAD, MANCHESTER 12



Bradwell Nuclear Power Station

Photograph by courtesy of the C.E.G.B. South Eastern Region

A section of the 132-kV switching station at Bradwell equipped with Reyrolle 3,500-MVA air-blast circuit-breakers.

Reyrolle also supplied through The Nuclear Power Group:

6·6-kV, 3·3-kV, and 415-volt air-break switchgear for station auxiliaries

Remote-control equipment for the switchgear and the reactors

Control-rod heads for the reactors

Burst-slug detection equipment

Stand-by supply equipment

TNPG

Reyrolle

MEMBER OF THE NUCLEAR POWER GROUP

A. REYROLLE & COMPANY LIMITED • HEBBURN • COUNTY DURHAM • ENGLAND

COULDN'T FIND ANY OTHER FLUORESCENT LAMPS WITH ALL THESE FIVE ADVANTAGES

You can search high and low but, wherever you look, you'll always find it's only Philips who offer fluorescent lamps with all five of these major advantages. So, for fluorescent that's far, far ahead, specify Philips!

1 De luxe lamps with double phosphor coating — Colour 32 the established choice for superb lighting of food; and Colour 34 for lighting clothes. Specify double-coated — they cost no more than single-coated de luxe.

2 Grain-size selected phosphors for maximum lumen output. Ultra modern machinery mills phosphor particles to the optimum size, rejects any that are not right. Hence the top luminous efficiency, maintained throughout the life of the lamp.

3 A special binder guards the electrode emissive coating and, together with high purity fill gases, ensures life that is getting longer and longer.

4 All standard lamps above have *both* silicone coating *and* earthing strip. 'Belt and braces' technique gives sure starting, means one stock type only for each and every fitting.

5 Fully closed anode ring (80w 5 ft.) reduces end-blackening and extends electrode life.

Once again

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COMMUNICATION CABLES

61/19G

Standard Telephones and Cables Limited

TELECOMMUNICATION ENGINEERS

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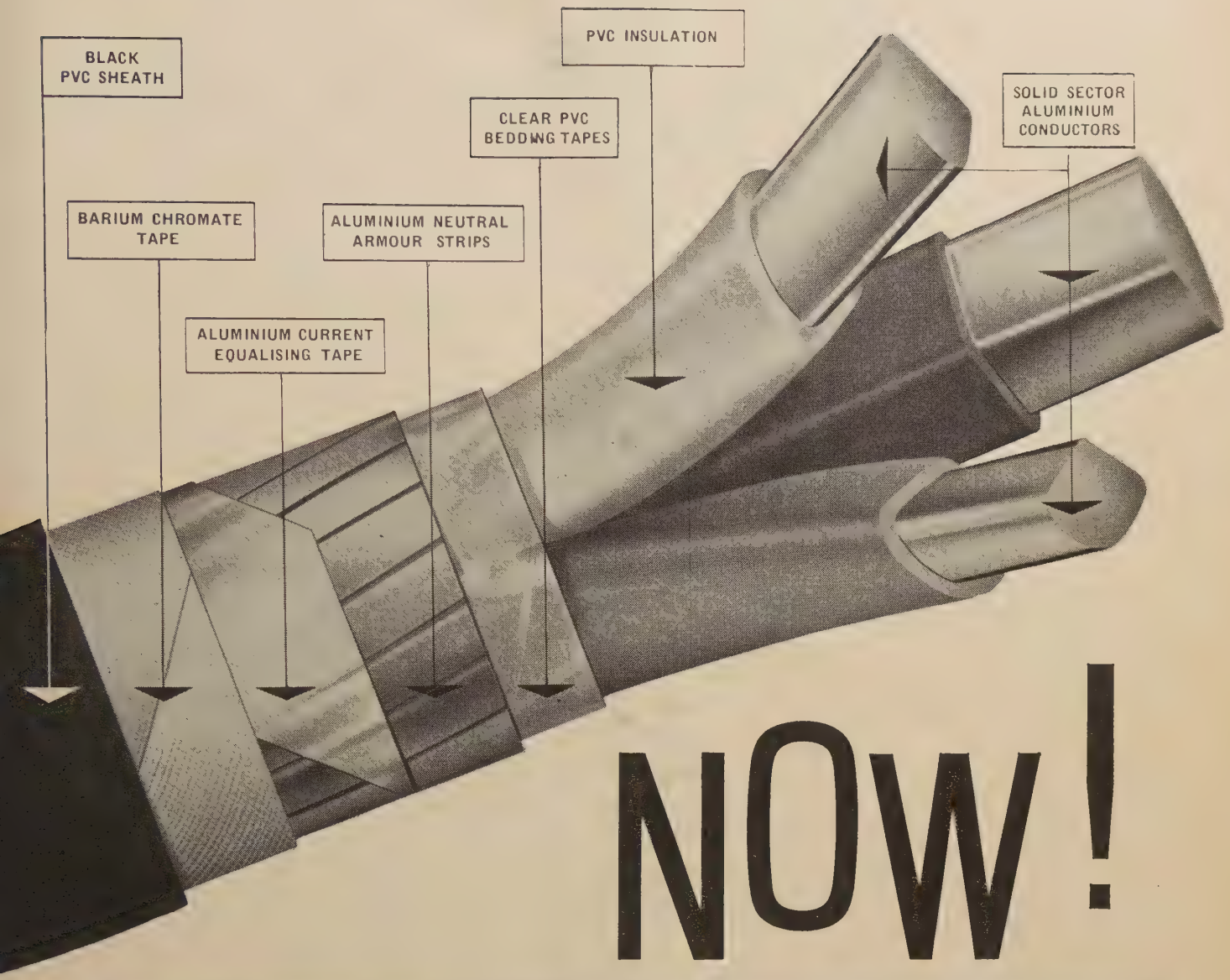
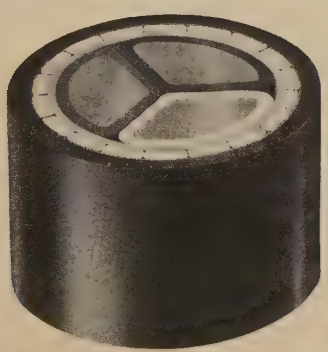


NOW!



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HEAD OFFICE AND WORKS: SWANSEA GLAMORGAN

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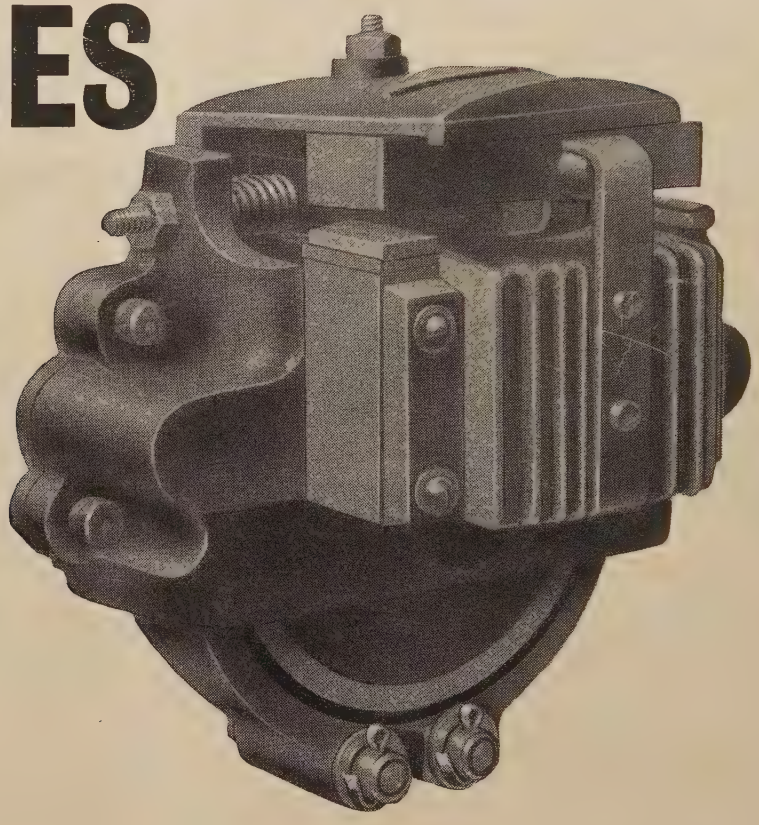

✳ 4″ or 6″ dia. drums. ✳ continuous retarding torque —4″, 6 lb. ft.—6″ 12 lb. ft. ✳ all A.C. and D.C. voltages up to 480 V. ✳ competitive prices. ✳ *quick delivery.*

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Registered Estd. McG 1832 Trade Mark

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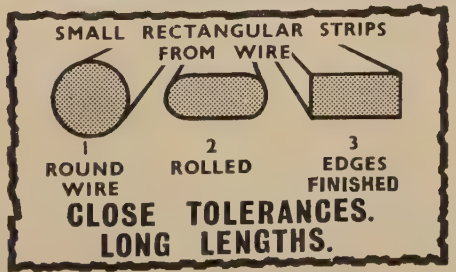

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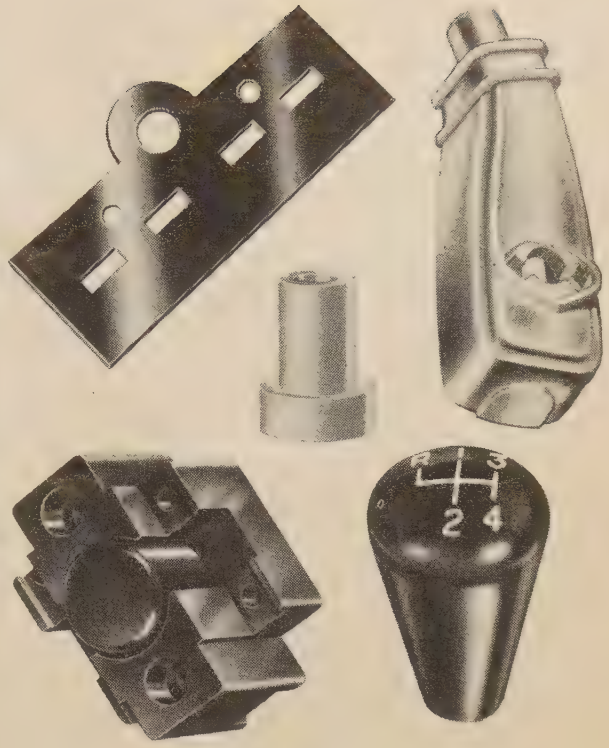

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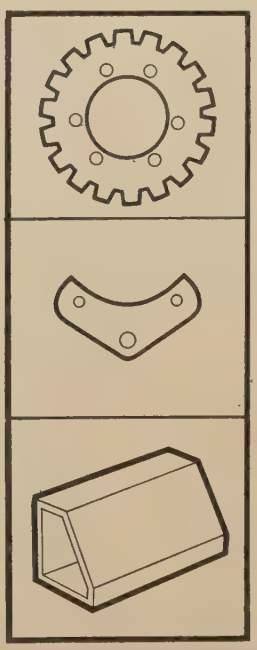

We supply insulations in the following materials suitable for condensers, commutators, heating apparatus and all electrical work.

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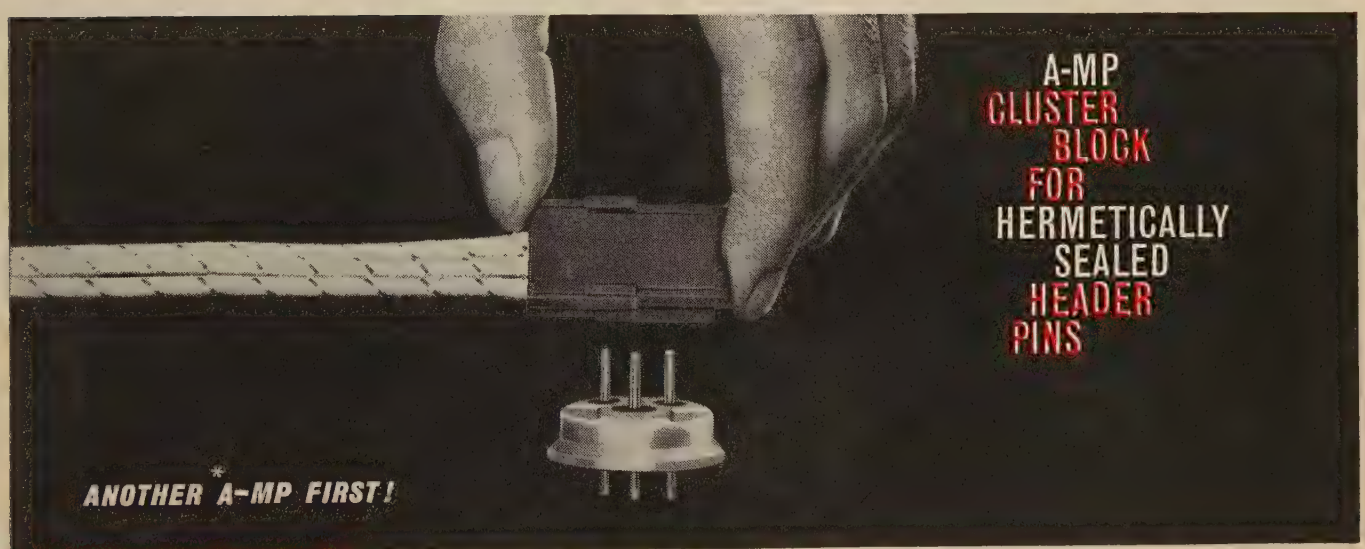

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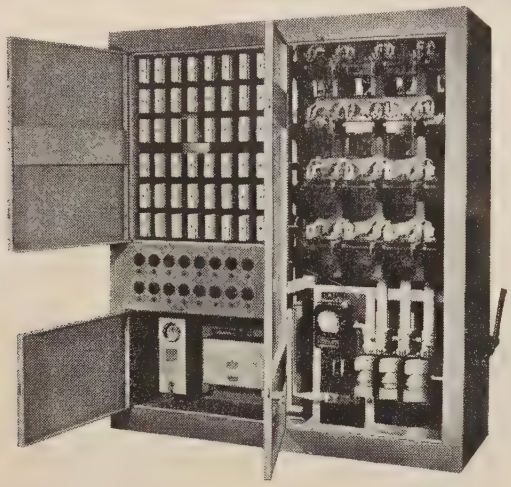
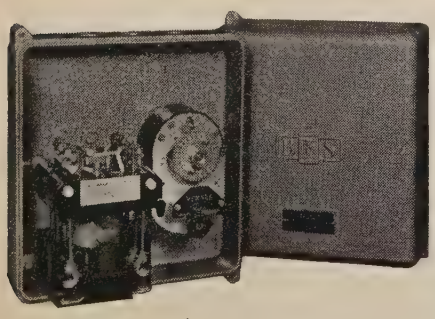


THERMAL STORAGE HEATING

With the special off-peak tariffs now available through the electricity authorities, the overall cost of thermal storage space heating has been reduced to a most economical figure. We are specialists in the design and manufacture of automatic panels for space heating control and have supplied panels handling up to 500 kW.
The panel illustrated handles 267 kW and is divided into 16 zones with individual limit thermostats and overall control by time switch; together with anticipatory control unit. We shall be most happy to quote for your automatic control panel.



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- Comprehensive range of contactors for all types of thermal storage and space heating control —10 to 350 amp. SINGLE, DOUBLE, TRIPLE AND FOUR POLE.
- FOR SILENT OPERATION. All models can be fitted with D.C. operating coil and rectifier.

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Flexible Cable Trunking

The problem of cable protection from moveable to stationary parts of control gear has successfully been overcome by the introduction of the Flexiguard cable protector.
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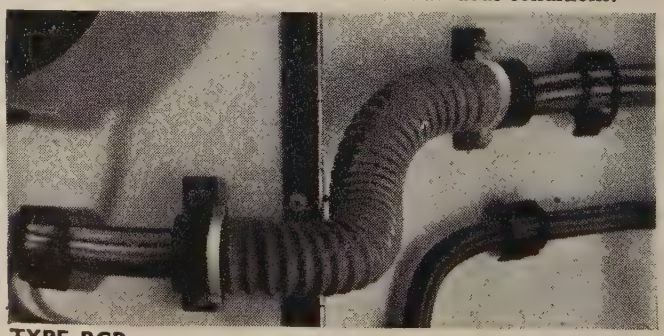
Reinforced Flexiguard (Type RCP) incorporates the same Nylon brackets as above but the P.V.C. tubing is strengthened by a helical spring along its length and is connected to the brackets by high-duty metal clamping rings. It is extremely robust—cannot kink and recommended for use under the most arduous conditions.

- **Quick and economical.**
- **Simple to fix.**
- **Completely secure.**
- **Gives guaranteed protection.**



TYPE RCP

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and ensure that you do not exceed your predetermined maximum demand

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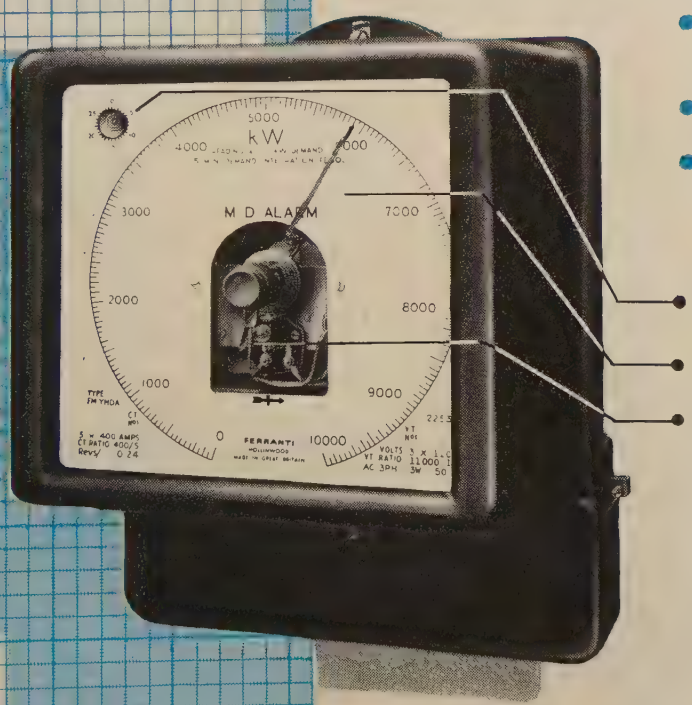
- Load reviewed every five minutes.
- Large clear dial for easy setting of maximum demand pointer.
- Load pointer and time dial clearly visible.
- Substantial contacts for operating separate warning device.



Time dial (5 min. resetting)

Target setting pointer

Load pointer

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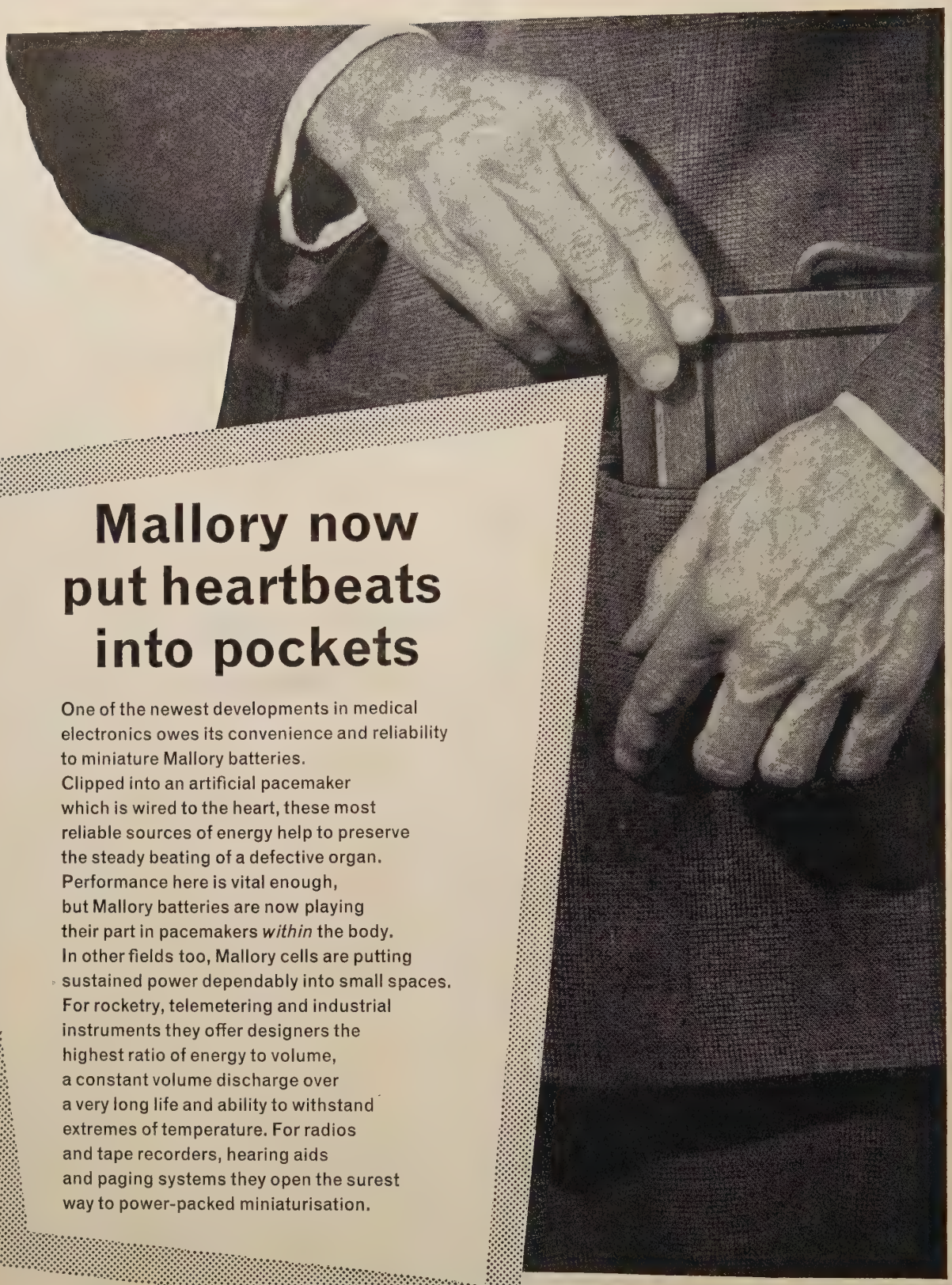

Mallory now put heartbeats into pockets

One of the newest developments in medical electronics owes its convenience and reliability to miniature Mallory batteries. Clipped into an artificial pacemaker which is wired to the heart, these most reliable sources of energy help to preserve the steady beating of a defective organ. Performance here is vital enough, but Mallory batteries are now playing their part in pacemakers *within* the body. In other fields too, Mallory cells are putting sustained power dependably into small spaces. For rocketry, telemetering and industrial instruments they offer designers the highest ratio of energy to volume, a constant volume discharge over a very long life and ability to withstand extremes of temperature. For radios and tape recorders, hearing aids and paging systems they open the surest way to power-packed miniaturisation.

Manufacturers are advised to consult Mallory at the design stage so that full benefit can be gained from the world's most space-saving source of power.

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miniature batteries for powerful applications

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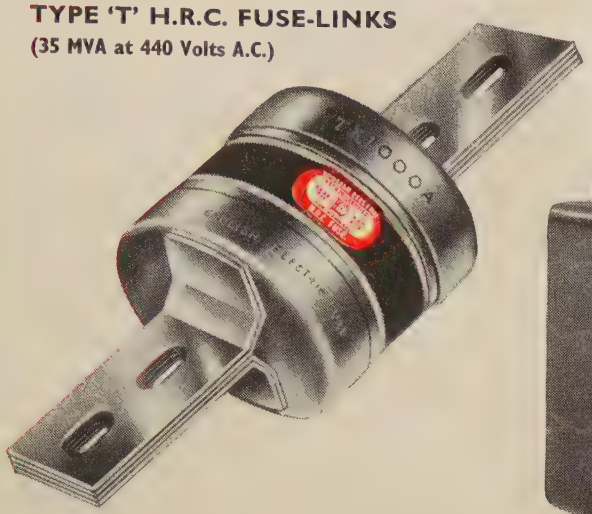
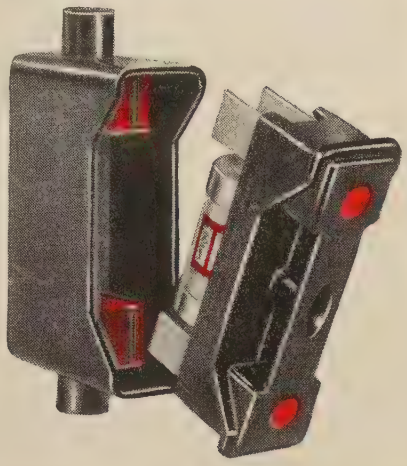
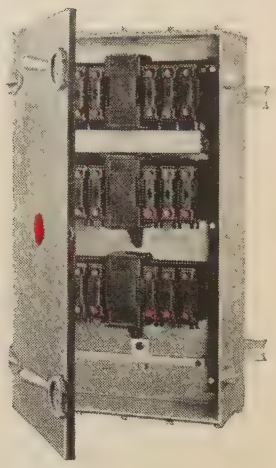
TYPE 'T' H.R.C. FUSE-LINKS
(35 MVA at 440 Volts A.C.)

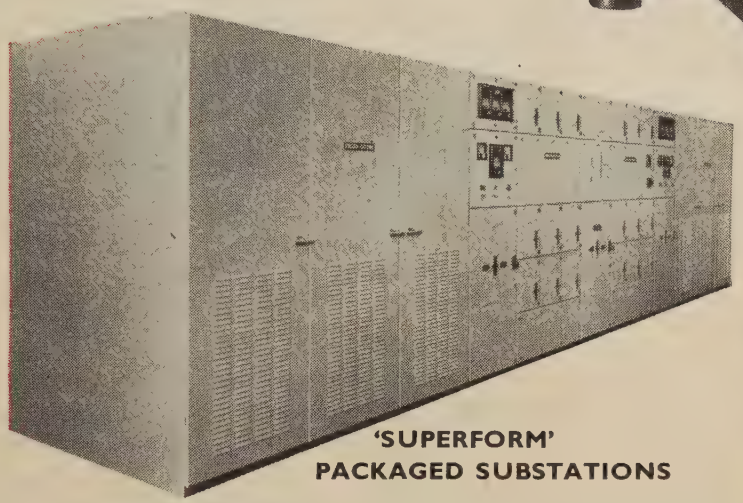


'RED SPOT' H.R.C. FUSE FITTINGS

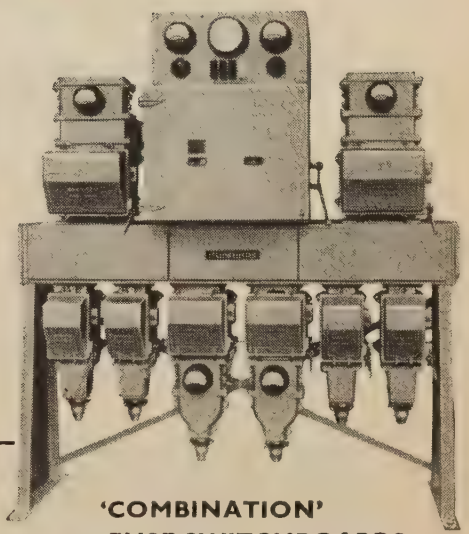




'RED SPOT' HEAVY DUTY FUSEBOARDS



'SUPERFORM' PACKAGED SUBSTATIONS



'COMBINATION' FUSE-SWITCHBOARDS

'ENGLISH ELECTRIC' manufacture:

H.R.C. CARTRIDGE FUSE-LINKS
*'RED SPOT' H.R.C. FUSE FITTINGS
*'RED SPOT' FUSEBOARDS
*'SUPERFORM' SWITCHBOARDS
*'SUPERFORM' PACKAGED SUBSTATIONS
*'COMBINATION' FUSE SWITCHBOARDS
*'COMBINATION' FUSE-SWITCHES
OVERHEAD BUSBAR SYSTEMS
OPEN TYPE SUBSTATION BOARDS ETC.

Trade marks of 'ENGLISH ELECTRIC'

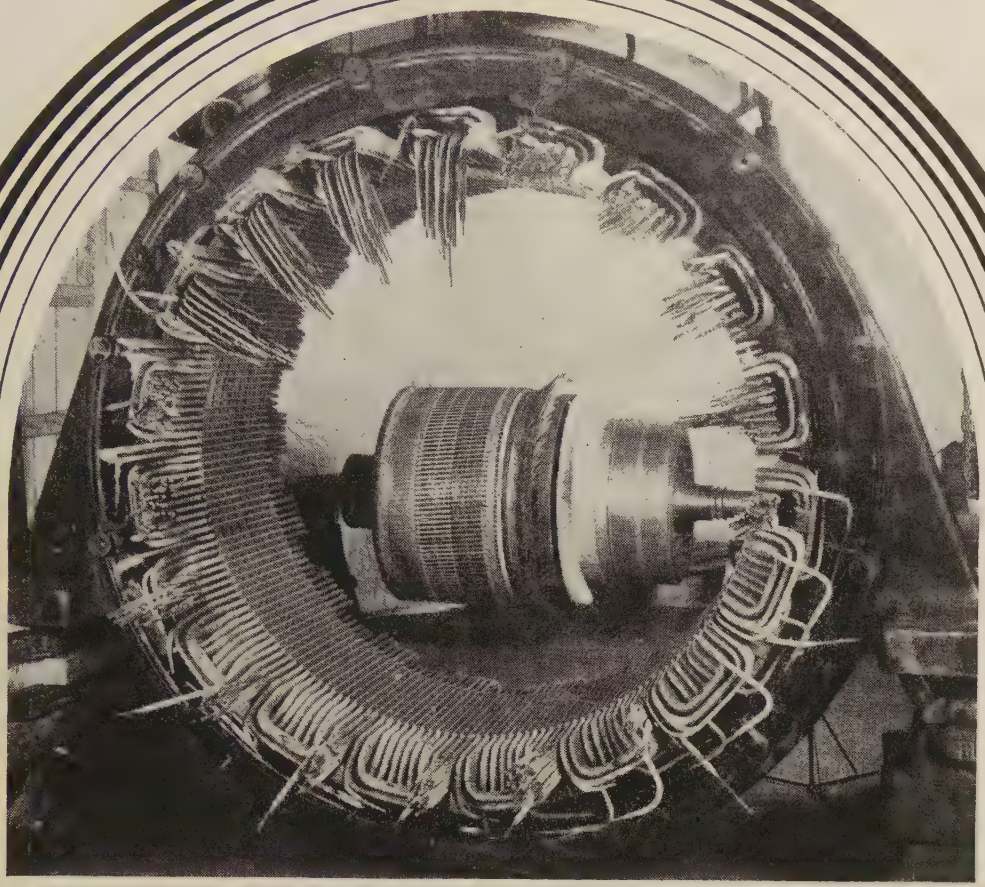
'ENGLISH ELECTRIC'

fusegear

FUSEGEAR DIVISION, EAST LANCASHIRE ROAD, LIVERPOOL 10

The English Electric Company Limited, English Electric House, Strand, London, W.C.2

FG.66C



Variety. Collins' comprehensive experience ensures there is always at least one interesting job going through their works. Here is the stator of a 1250 H.P., 6,600 V., 246 r.p.m. English Electric Motor undergoing complete rewind. In the background is an Armature from a 250 H.P. B.T.H. C.H.T. variable speed motor.

COLLINS

Collins Electrical Ltd.

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Central London Works

22 St. Albans Place Upper Street Islington N 1

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9 & 11 Featherstone Road Southall

Phone Holborn 0212-4 Canonbury 3227-8

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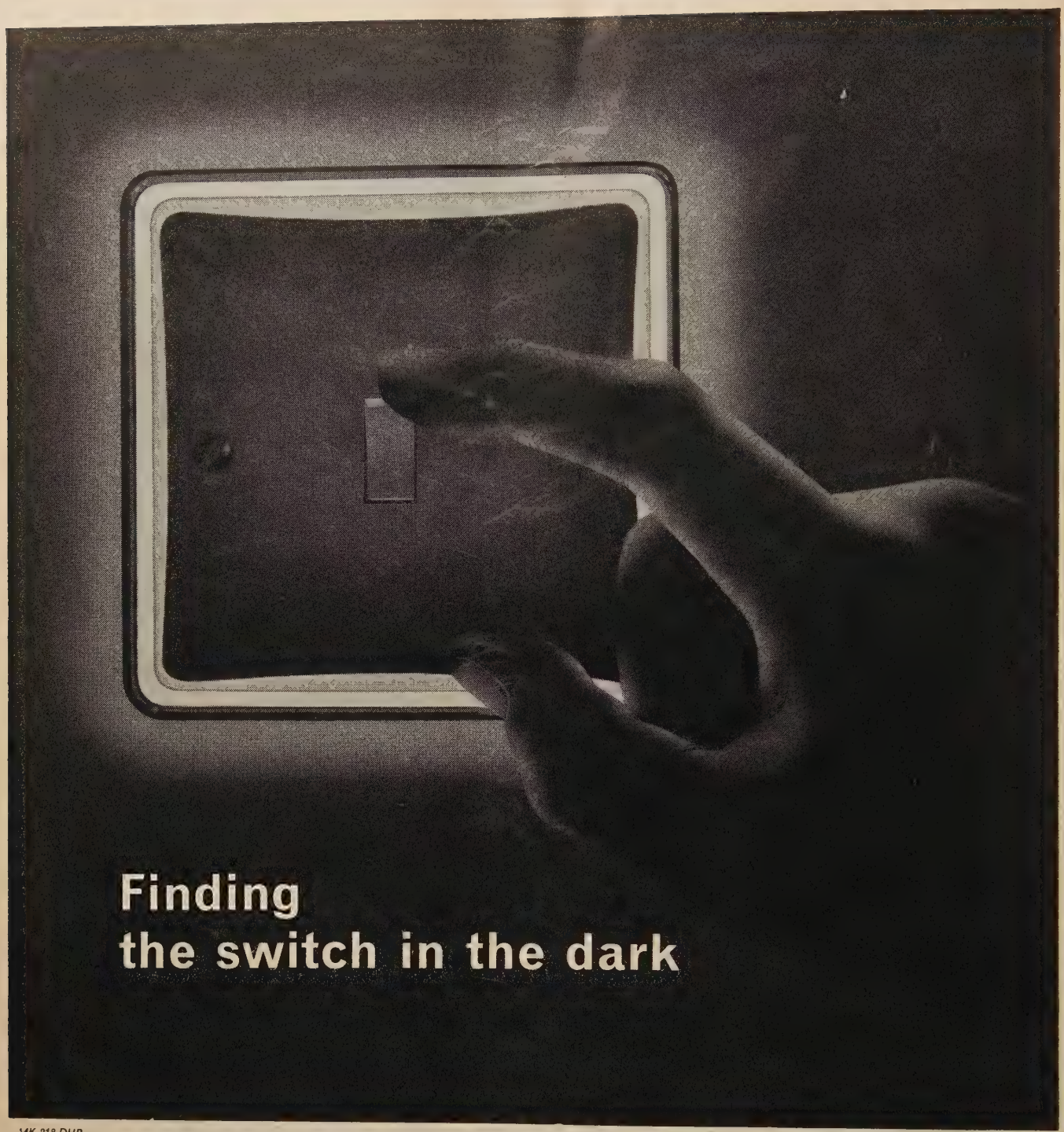

VK 218 DHB

MK

LUMINOUS LOCATOR

Groping in the dark to find a switch or socket-outlet frequently results in clashes with furniture and also finger-soiled walls. The solution is to see them, not to 'feel' for them.
The M.K. Luminous Locator is a neat fitment which surrounds any British Standard flush switch or socket-outlet which has two fixing screws on 2⅜" centres.
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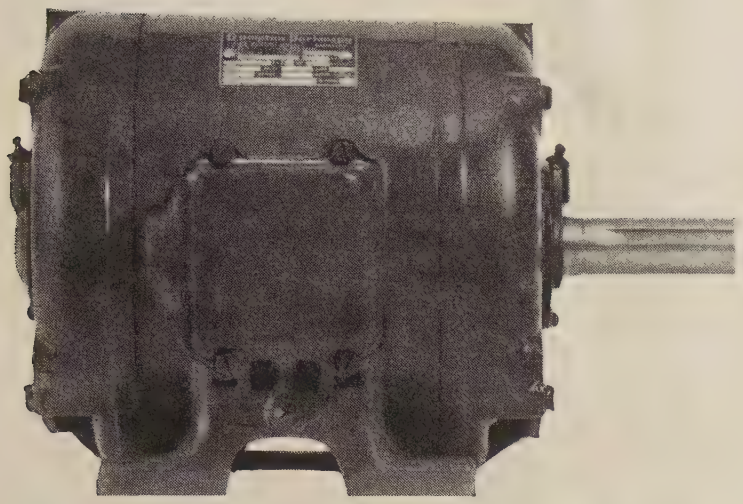

You can usually divide the designing of any piece of equipment into two parts. The first—mainly theoretical—determining the basis of performance; the second—mainly practical—concerned with how the thing shall be made. Whereas the first proceeds from well-established principles held in common by all engineers, the second draws largely on the experience which has been accumulated over the years by a single manufacturer: his know-how. It is usually on this second aspect of design that the differences between one manufacturer's product and another's depends.

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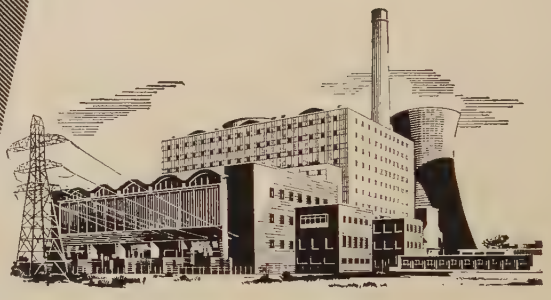

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ELECTRICAL REVIEW

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IN THIS ISSUE

NEWS SECTIONS

ELECTRICAL REVIEW

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Apprenticeships

WHETHER a student of the engineering profession obtains his theoretical knowledge by uninterrupted full-time study, through a sandwich course, or by part-time day or evening classes, some period of practical industrial training is essential. The Institution of Electrical Engineers defines " training " as the " acquisition of experience of engineering practice and of the techniques appropriate to a professional engineer." The aim of an apprenticeship is, therefore, to demonstrate to the pupil how practical engineering problems are solved by the use of appropriate tools, processes and materials. Only when such experience has been acquired can a professional engineer convert his ideas economically into useful equipment.

The various engineering institutions have long recognised the importance of adequate practical training and, from time-to-time, new or revised recommendations are issued by them. It is, of course, in the institutions' interest to try to ensure that proper training is provided since proof of an industrial apprenticeship is one important requirement for corporate membership. The institutions cannot, however, rigidly control the form or quality of such training and can only make recommendations. Nor can they ensure that there is a sufficient quantity of apprenticeships available within industry. We have referred to this lack of a sufficient number of training facilities previously, but we feel there is also a case for some comment on the quality of existing training courses.

Most engineers in their thirties and over who look back upon their apprenticeships will admit that their industrial training was not all it should have been. Since then things have changed—or have they? In the December issue of the *Students' Quarterly Journal* of the Institution of Electrical Engineers, an article by a graduate at present on a training course, " somewhere in England," strikes some all too familiar chords.

One of the leading characters in this article is the " Edification Officer " —a type which many of us will instantly recognise. He always has a ready excuse as to why an apprentice cannot be transferred from some useless occupation to one of more significance. This is perhaps due to the E.O. having insufficient executive power, coupled with some weakness in his drive, particularly in the case where the higher management looks upon apprentices as a necessary evil to be counteracted by the use of their cheap labour in some repetitive job. Then there are the foremen and other workers on the shop floor who object to apprentices " coming around here prying on us and flogging our learning." This is, of course, a case of bad industrial

relations which can be overcome by a dedicated education officer backed by an enlightened management. The apprentices themselves are not blameless as they can cause much bad feeling, but here again the E.O. should be able to detect the individual engendering the disturbance and take the necessary action. It would seem, therefore, that not only must management realise the importance of adequate training facilities but must be made aware that the quality of such training must be of the highest character. The education officer must be given higher managerial status than appears to have been the case hitherto.

REFRIGERATOR RATIONALISATION

During the last two or three weeks some newspapers have been suggesting a general " get-together " of British refrigerator makers in order to rationalise production. They have envisaged huge amalgamations of the refrigerator departments of the leading manufacturers or even total mergers. But the only actual result so far has been the announcement by the English Electric Co. and the Prestcold Division of the Pressed Steel Co. of an agreement to manufacture " certain domestic electrical appliances and components on a reciprocal basis." This, of course, is not an entirely new departure, for other units in the industry are already " taking in one another's washing " in this way.

Returns so far this year show that sales of refrigerators have been well below last year's; it is expected that by the end of the year about 800,000 will have been disposed of, against 929,000 in 1960. For this reduction the makers put the main blame on to the altered hire-purchase arrangements which call for an increased initial payment. Stocks are said to have been reduced satisfactorily and it is to be hoped that production and demand will be more nearly matched in future.

THE COST OF RESEARCH

The money spent on research in this country is widely recognised as being well worth while, although the results of research are not always immediately discernible. The returns from such work are in direct proportion to the amount of money spent. During the year ended 30th June last the National Research Development Corporation spent the record sum of £812,000 in backing British inventions. The work of this body covers a very wide range and at present it is financing nearly 40 development projects. Electrical work being conducted embraces automatic process plant control, a system of television bandwidth compression, computers, fuel cells and variable speed motors.

This organisation certainly gets a return for its efforts, since during the year it received £47,000 through patent agreements and royalties. The N.R.D.C. now has rights in 3,400 British and overseas patents and patent applications, derived chiefly from publicly-supported research carried out in Government establishments, the Research Councils and the universities. The Corporation's exploitation income from royalties, options and the like amounted to £232,000, which included non-recurring payments. The essential element of this annual income was recurring royalty payments of £188,000. Altogether the N.R.D.C. has made a very satisfactory year's progress.

BOILER FEED PUMPS

One of the interesting developments referred to in the annual report of the Central Electricity Generating Board is in connection with boiler feed pumps and feed heating systems. It seems that all units of 300 MW and above are to have turbine driven boiler feed pumps which are integrated into the feed water heating system. The reason for employing this type of drive is that it is not tied to the mains supply frequency and therefore has the advantage of choice of optimum speeds. In some of the earlier designs of plants of this rating, the boiler feed pumps were placed after the feed heaters which were therefore subject to an operating pressure of only about one-third of the boiler pressure. Now, the development of economical high pressure feed heaters capable of operating at full boiler pressure has resulted in the placing of the feed pumps before the heaters in the designs for the 350 MW and 500 MW plants ordered during the past year.

For driving starting and standby feed pumps it is the intention to make increasing use of variable-speed slip-ring induction motors with liquid controllers. For instance, the 11 kV motors for the 375 MW supercritical unit at Drakelow " C " will be rated at 11,400 h.p., 980/490 r.p.m. At West Thurrock slip energy recovery equipment has been ordered for use with the variable-speed slip-ring motors associated with the electrically driven boiler feed pumps. Another interesting point in connection with motor drives is that the tendency for circulating water pumps to be designed for increased outputs at relatively low speeds has made the synchronous motor a more attractive proposition than hitherto and at Drakelow " C " 11 kV, 333 r.p.m., 3,300 h.p. motors of this type will be employed.

WHOLESALING POLICY

Continuing the drastic changes in structure and policy, the General Electric Co., Ltd., has decided to cease its wholesaling activities and the newly-formed manufacturing subsidiaries of the company will conduct their sales, by individual arrangement, through outside wholesalers. In point of fact the G.E.C. has been doing much of its business through wholesalers for some time and so the announcement just confirms and completes a policy already being pursued.

Naturally the Electrical Wholesalers' Federation welcomes this decision. In the past its relations with the G.E.C. have not always been of the happiest. It claims, with some justification, that the independent wholesaler not only provides a more efficient and complete service to the retailer but does it more cheaply than the manufacturers can do it for themselves.

FEED PUMP DRIVES

By L. O. WILD, A.M.I.Mech.E.*

Power plant auxiliaries and services have increased in complexity from the simple cold water feed pump to the present arrangement of heaters, fans, pumps, valves and piping. In this article the author deals primarily with feed pumps, and he discusses the design and construction of various forms of drives as well as the relative economic merits of alternative schemes

THE original driver for the auxiliaries in a power station was often a steam engine, this being replaced in time in some cases by a live steam turbine. The use of steam for driving auxiliaries was an obvious choice, for apart from the fact that it was at that time the most efficient method, there is also a lot to be said for a self-contained unit which is not dependent on any external supplies. With the development of the electric motor a new driver became available and it was almost universally used. The reasons for this were the availability of relatively cheap, simple and reliable motors having running costs that were considered acceptable. This situation existed until a few years ago when, with the introduction of higher steam conditions and sizes of turbo-generators, a review of the situation showed that other forms of drive might be more economic.

A station consisting of four 500 MW turbo-generator units has an auxiliary power requirement of about 200 MW, that is, more than the total output of the size of power station which was designed around the war years, and as the power required to drive the auxiliaries can be considered to be a reduction in the sent-out capacity of the station it involves a considerable loss of revenue. Furthermore, to produce electricity with all the attendant losses involved only to convert it back to heat immediately with further losses appears indefensible unless some advantage is secured. The fact is that with the majority of auxiliaries the capital cost involved in using any form of driver other than the electric motor makes them uneconomic. The main exception is the boiler feed pump which has the largest power requirement of any auxiliary and it is therefore proposed in the rest of this article to deal with this plant item alone.

Size of Set

The size of turbo-generator under consideration as an example will be a 500 MW unit and it is important to note that any conclusions reached apply to this size of set only, with the stated conditions, at this particular time, because (as is the way in engineering) a change in the system or a development of some items of plant could result in different conclusions. The object of this exercise is therefore to discuss a method of procedure for this type of analysis.

The unit consists of a boiler with an evaporation rate of 3,260,000 lb/hr and a final feed temperature of 485°F together with a 500 MW turbo-generator; a 3,000 r.p.m., tandem compound machine, having a stop valve pressure of 2,300 p.s.i., temperature 1,050°F and reheat 1,050°F. The types of drive that will be considered for the feed pump in this unit are as follows:—

1. Constant speed motor and variable speed coupling.
2. Variable speed motor.
3. Bled steam turbine.
4. Main shaft coupling.

There are several other forms of driver that could be used for this purpose, but there are serious objections against most of them. For example, live steam turbines with local boilers are expensive and create layout problems, whilst a turbine operated from the unit boiler at high pressure is expensive and inefficient. Gas turbines are a possibility if a suitable fuel is available, but the author has not completed the relevant investigations in this field.

Duty Required

It is first necessary to define the duty and what is required from the driver. For example, the economic speed; whether or not the introduction of variable speed will show savings; speed of response of the pumping set if variable speed is included; and the need for and the time period allowable for starting standby units. The British system is designed to operate on a frequency of 50 c/s, but allowance must be made for occasional reductions of, say 4 per cent, from normal, that is, to 48 c/s. This means that any auxiliary, mechanically or electrically connected to the turbo-generator set, must be designed to deliver the output demanded by the turbine and the boiler at the reduced speed resulting from such a drop in fre-

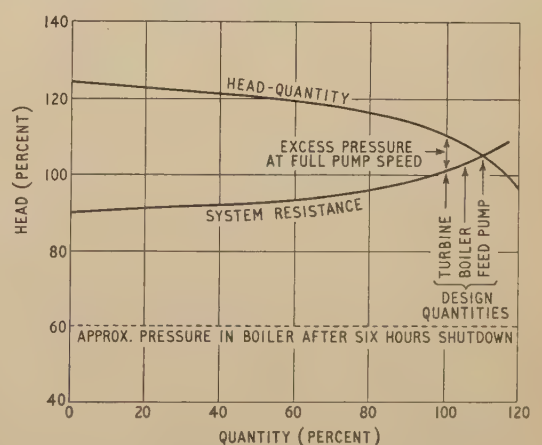


Fig. 1.—Feed system and pump (characteristic)

* Power Plant Design Branch, Central Electricity Generating Board.

quency. For this reason the power requirements at full turbo-generator load of all drives other than the bled steam turbine will include a margin for this purpose at normal frequency.

Variable Speed

Excess quantities of feed water over the boiler design requirements must be included in the pump duty to meet not only the above-mentioned reduced frequency condition but also operational margins and pump wear. Furthermore, it is the practice to design the boiler for a higher steam rate than the turbo-generator and therefore at turbine c.m.r. a considerable excess quantity is available (see Fig. 1). This is converted into a pressure drop through the regulating valve and thus an increase in feed water temperature. It is, however, a highly inefficient way of providing feed heating, and it can result in excessive wear on the regulating valve. On typical British sets of 200 MW and above, the losses involved in this breakdown of pressure outweigh the cost of providing a variable speed driver. In addition to this, with a system (such as the C.E.G.B.'s) in which it is intended that the greater part of the base load output will be provided by either hydro or nuclear power stations, all conventional plant must be designed for two-shift operation, i.e. to be shut down overnight for much of its life. During an overnight shutdown the boiler pressure falls several hundred pounds per square inch, which means that during the start-up next morning the feed pump is only required to deliver some 1,500-1,700 p.s.i., instead of the 3,300 p.s.i. closed valve, full-speed pressure of the pump. For this reason the pump that is used during the starting time should have a speed range down to approximately 70 per cent full speed to avoid excessive wear on the regulating valve.

Economical Speed

Modern feed pump design has resulted in the use of relatively high rotational speeds, the highest in this country at present being 6,500 r.p.m. With drivers independent of the generator the speed can be selected as being the most economical for the combination of pump and driver; up to now the faster the pump operates the lower its cost. On the motor driven or main shaft driven sets the exercise is not so easy. For the variable speed motor it is desirable, if 70 per cent speeds are required, to limit the motor running speed to 1,500 r.p.m. in order to avoid running on a critical speed of the motor rotor. In this case a gearbox can be fitted, usually of the epicyclic type, the cost of the gearbox and its operating losses being offset by the reduced cost of pump and motor. With regard to the constant speed motor driven pump fitted with a variable speed coupling, the introduction of a gearbox would also result in considerable saving, but this arrangement would be rather cumbersome and possibly troublesome due to having the motor, coupling, gearbox and pump all in line, each with its own bearings. The alternative to this is to omit a number of bearings and build in certain of the plant together. The coupling could be hung between the motor and the gearbox, but there would arise the possibility of divided responsibility amongst the manufacturers. It is for these reasons considered preferable to omit the gearbox in this arrangement.

The question of how many pumps to install is difficult to answer without a great deal of data and experience. Whilst it is the general practice in this country to provide two 100 per cent duty feed pumps, many utilities prefer three 50 per cent duty pumps. There is here involved a basic difference in philosophy in that while it is true that the more pumps installed the less is the loss of load when a pump is out of commission, it is also true that the more pumps used, the greater the number of connections, valves and apparatus that can in fact go wrong, which would increase the likelihood of failure.

As a general rule the cost of two 100 per cent duty pumps is approximately the same as that of three 50 per cent pumps, though the size of pipes and valves and the form of driver can slightly alter this assessment. The efficiency of the units is of the same order when considering sets of 500 MW; for smaller flows, however, efficiency differences of up to 3 per cent may occur, this therefore favouring the 100 per cent units. All modern power stations designed by the C.E.G.B. have a 100 per cent duty main feed pump with at least 100 per cent standby capacity provided.

Standby

The number of boiler feed pump failures is not great, and it is very unusual for one to shut down a generating unit, but the cost of such an outage when it does occur is so great in relation to the cost of standby boiler feed pumps that it is considered that 100 per cent duty standby is justified. On the electric motor drives this can be provided by a duplicate 100 per cent duty pump, but for the other drives there is a further consideration. Until water is pumped into the boiler the main feed pump is out of service which means that a starting pump must be provided. This pump is usually driven by an electric motor. If the whole of the standby capacity and starting pump were provided in one fully electric motor driven unit the failure of this pump before or during the starting period would result in an inability to start the main set. In other words, for a two-shift station the starting pump is as essential a part of the complement as the main pump. The two duties of starting and standby can be covered by having two 50 per cent duty motor driven pumps, either of which is suitable for carrying the boiler up to a point at which the main pump can take over, whilst together they can supply the full requirements of the boiler.

Disposition of Feed Pump

The decision to place the boiler feed pump before or after the heaters depends on the relative costs of high and intermediate pressure heaters. On sets up to 60 MW and in a few cases above, it has been the practice to provide the bulk of the feed heating after the feed pumps. With larger sets having higher steam conditions it has until quite recently been economical to install intermediate pressure heaters and pumps between these heaters and the boiler (see Figs. 2a and 2b). Due to the rapid increase of unit size and advances in the methods of heater manufacture the use of high-pressure heaters has again shown advantages and has been adopted for the most recent 350 and 500 MW machines (Fig. 2c). Mention is made of the disposition of the feed pump in this article because it directly affects the drivers. Where intermediate pressure heaters are used booster pumps are

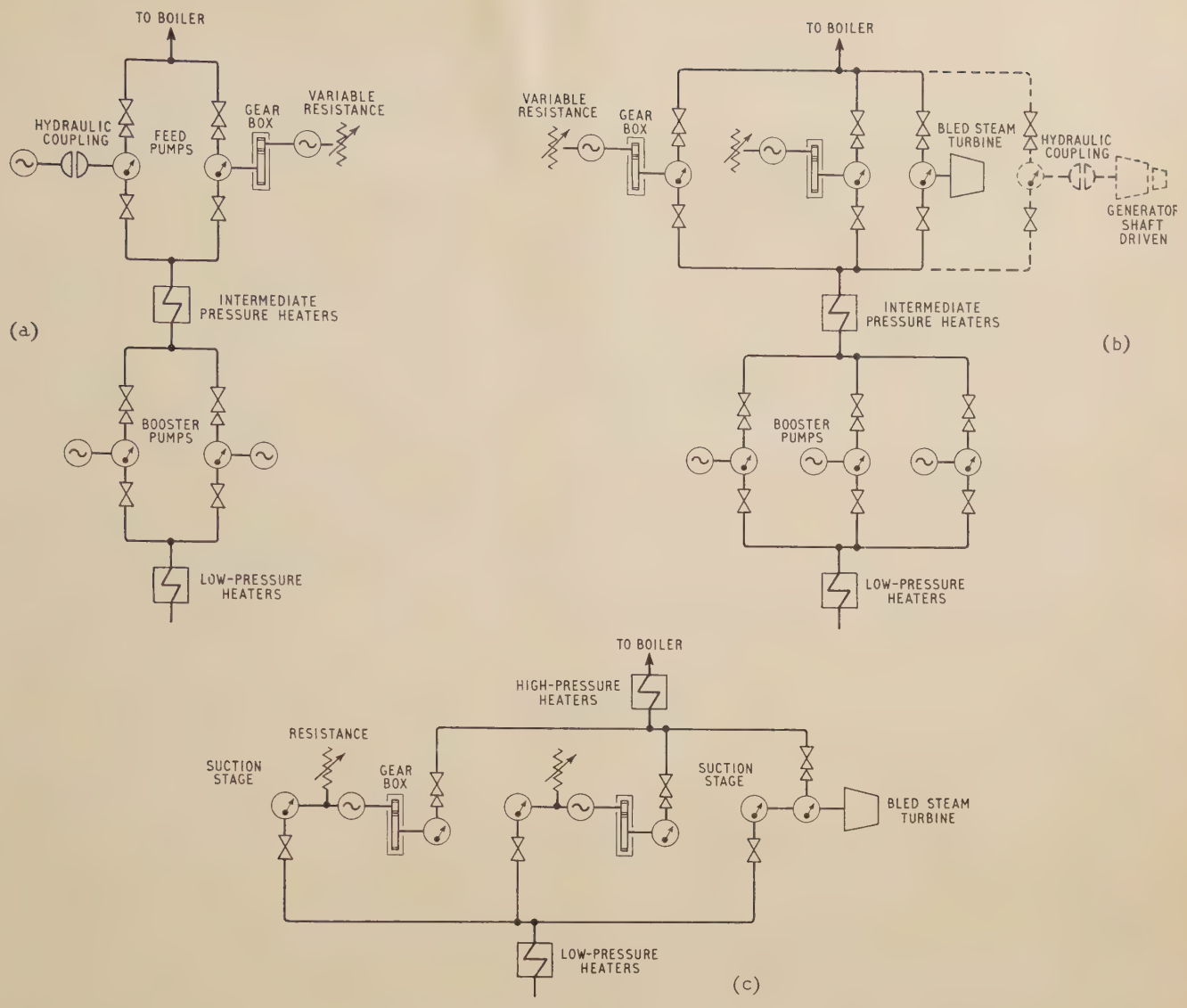


Fig. 2.—Diagrammatic arrangement of feed pumps

required to provide sufficient suction pressure at the feed pump inlet to prevent flashing in the first stage suction passage. As the water at the inlet would be at a relatively high temperature, say 450-500°F, the boiler feed pump depends on the booster pump to provide sufficient positive suction head for it to operate and failure of the booster would result in considerable damage to the feeder and possibly even complete seizure. On sets of 200 MW and below (Fig. 2a) with all-electric motor-driven pumps this security is readily ensured by electrical interlocking.

The booster pump arrangement for the separately driven boiler feed pumps (see Fig. 2b) cannot be so treated. It is for this reason that three booster pumps are included, each nominally rated for 50 per cent duty but capable of supplying individually sufficient pressure and quantity to prevent flashing in the eye of the main pump under normal operation. Two pumps would be normally working together with the third on automatic standby.

On the 500 MW sets under consideration it is economic to provide high-pressure heaters and therefore as the pumps are dealing with water at de-aerator temperature, separately driven booster pumps are not required. However, the high-speed pumps require more suction pressure than that provided by the static height of the de-aerator under some conditions of operation and therefore a special suction stage is provided in a separate casing. This is considered a wise precaution, for if trouble is experienced with the first stage it is better if the whole pump does not have to be dismantled to attend to it. This separate stage can be driven at a lower speed if necessary than the main pump, either from the normally non-driving end in the case where a gearbox is used between main pump and motor, or through a gearbox if the driver and the pump run at the same speed. A second effect of the lower pump operating temperature is that the power quantity characteristic of the pump does not match the ungoverned turbine output so well at part loads and a more complicated governing gear is called for.

Types of Drive

Consideration can now be given to the actual drivers. In each case it is proposed first to outline the proposal and then give any advantages or disadvantages that can be seen.

1. *Constant Speed Motor and Variable Speed Coupling.* The actual driver would be an a.c. squirrel-cage

motor designed for direct-on-line starting. The variable speed coupling would be of the hydraulic or electromagnetic type suitable for a speed range of from 100 to 70 per cent of top speed. The motor is of relatively simple design and low cost and runs at 3,000 r.p.m. Hydraulic couplings are quite satisfactory for the duties required and have proved to be reliable in service. (Mention is made of the possible use of electromagnetic couplings and this device is being kept under observation: at present only couplings of up to 1,000 h.p. have been built successfully, but couplings of 7,000 h.p. are being built for feed pump duties and if found satisfactory and the estimated cost and efficiencies are confirmed they may well be more economic than a hydraulic coupling.) Whatever type of coupling is used, however, there is the loss in it to be evaluated. First, there is the loss in efficiency of some 2 per cent when operating at full speed. There is also the inherent waste of power during reduced speed running as the dissipation of heat in the coupling cooler obeys the following rule, $\frac{\text{h.p.1}}{\text{h.p.2}} = \frac{\text{r.p.m.1}}{\text{r.p.m.2}}$, that is the speed is reduced at the expense of a slip loss. For a 500 MW set running at turbine c.m.r. this dissipation is in the order of 1,000 h.p. which when capitalised involves a considerable sum.

One disadvantage of this type of drive is the cost of providing an auxiliary electrical supply system suitable to withstand the starting current of about six times full-load current which would cost something in the order of £20,000 over an auxiliary supply system suitable for a slip-ring motor. Another disadvantage is that because a gearbox (referred to above) is not considered acceptable, the pump top speed is limited to the speed of the motor and this results in not only an expensive pump, but also a considerable number of stages for the pressure involved and therefore a very large span between bearings.

2. *Variable Speed Motor Drive.* There are several types of variable speed motors that could be used but in view of the fact that the pump is designed to operate for most of its life at 95 per cent full speed (see Fig. 1), the slip-ring motor is probably the most economical. The speed controller would be of the liquid resistance type. The large speed range for starting purposes that it must be designed for results in an efficiency at full load equivalent only to the overall efficiency of the squirrel-cage motor and coupling combined. Furthermore, the heat dissipation in the coolers is the same as with the coupling drive so the essential advantage in this variable speed unit is the easing of the starting current on the auxiliary electrical supply system. It is, therefore, the preferred unit for standby duties where the intention is to lower the capital cost, the efficiency of the unit not being of so much importance.

As stated above, because of problems in designing the motor for 100-70 per cent speed range, it is preferable to limit the maximum speed of this motor to 1,500 r.p.m. A gearbox is therefore included and the pump speed can be the most economic for the pump. The liquid regulator proportions are very large and have a volume of some 1,500 cu ft. Stepped resistance controllers have also been considered, but unless an extremely costly arrangement of a large number of steps is used the jerky motion whilst changing from one speed step to another may well set up hunting in the system and for this reason this type of control is considered unacceptable. One difficulty with this arrangement is the requirement that when starting the motor the resistance must be on the lowest speed position. This means that the regulator cannot be locked with the boiler controls at all times, but provision must be made to provide a hydraulic, pneumatic, or some other form of link to connect the controller when the motor has started. On any of the other drives considered a permanent link can be made, the drive "ghosting" the required action when not operating.

3. *Bled Steam Turbine Drive.* The bled steam turbine is usually designed to take steam after the high-pressure stage of the turbo-generator set (from the cold reheat pipe) and exhausts to a feed heater or heaters. The characteristic over the 40-100 per cent range of turbine loads is favourable since the power available from an ungoverned turbine working between two pressures (each of which is determined by the main turbine governor) falls roughly in proportion to the boiler water demand as also does the power requirement of a variable speed pump. The turbo-feed pump for a 550 MW set is illustrated in Fig. 3.

Advantages are obtained by integrating the turbine in the feed heating system as shown in Fig. 4. By bleeding the steam from the main turbine just before the cold reheat line the size of reheater and also the piping can be reduced,

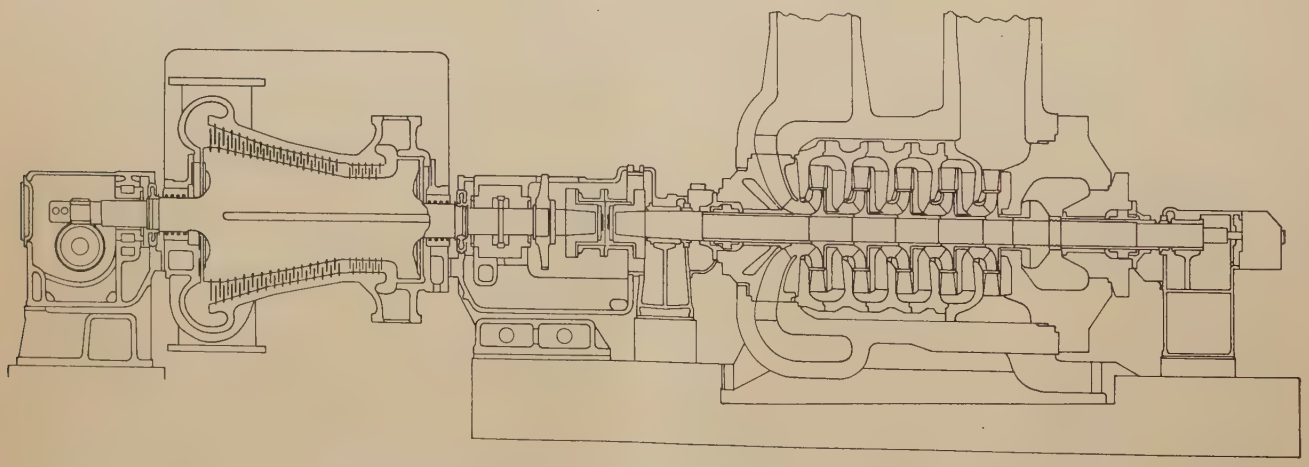


Fig. 3.—Arrangement of a Parsons bled steam turbine driving a Weir pump

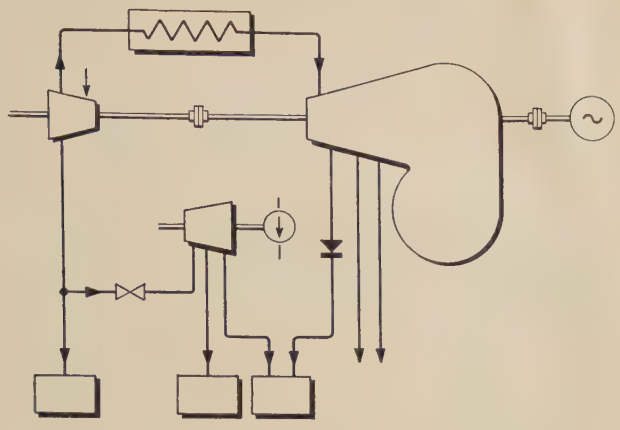


Fig. 4.—Diagrammatic arrangement of feed heating system incorporating bled steam turbine driven feed pump

this resulting in a considerable reduction in cost which greatly outweighs the increased cost of the boiler and main steam pipes if the electrical output is kept constant, or the value of the loss of output if the size of the boiler is fixed. As previously stated for this drive, starting and low duty pumps are required for loads up to about 50 per cent unless a complicated system of valves is included to enable the turbine to receive steam direct from the boiler.

4. *Turbo-Generator Shaft Driven Pump.* In this arrangement the input shaft of a hydraulic or electro-magnetic variable speed coupling is flexibly connected to the turbo-generator shaft and the output shaft to a boiler feed pump. The actual drive is cheaper than any other arrangement as far as capital charges are concerned, but when the extra costs referred to in "Comparison of Drives" below are allowed it is less attractive than the bled steam turbine arrangement. There are several other factors that could make it unacceptable such as that the coupling must be at a sufficient distance from the generator to allow withdrawal of the rotor and this may well lead to a larger building, involving additional costs. Also it is usual to drive various other auxiliaries through the generator shaft, e.g. the exciter and blower. The inclusion of a variable speed coupling and feed pump offsets these auxiliaries a considerable distance from the centre line, thus creating a further drive problem. Furthermore, an additional cost may be involved in designing the generator to accommodate this drive. However, the force of these considerations depends very much on the arrangement of the turbo-generator adopted.

The effect of a pump or coupling breakdown on the operation of the turbo-generator must be taken into account, but this would not be serious unless an input shaft of the coupling was at fault. Any other failure can be catered for by arranging the coupling to unload in the event of any significant rise of temperature of the coupling fluid, thereby removing the driving medium between the turbo-generator set and the pump. Some form of brake is required to completely stop the pump unit in order that it may be mechanically disconnected from the turbo-generator for on-load maintenance. As in the case of the previous drive, starting pumps must be provided.

Comparison of Drives

It is notoriously difficult to assign valid costs to marginal changes in the duty of components, but if the largest components can be kept at sensibly constant duty the difficulties are minimised; even although the picture then presented is to a degree artificial, the conclusions drawn can be applied with reasonable accuracy and assurance to the conventional practice in which, say the gross output from the generator, is kept constant and other components varied. That is the approach developed below. The evaporator and superheater sections of the boiler have been kept at a constant duty. The generator has been kept at constant physical size (a particularly reasonable thing to do when the maximum size of generator available has itself fixed the unit rating) and the losses allowed to vary. Changes in the main turbine have been costed as variations of performance under these conditions.

It is considered that in view of the rapid developments (and therefore cost changes) which have been occurring during a relatively short period, it would be out of place here to detail all the capital sums involved in a comparison of the various types of drive. The arguments may, however, be stated in general terms as follows:—

Main Feed Pumps. This item includes the pump, suction stage and gearbox, if fitted, leak-off valves, non-return valves and flexible couplings.

Main Feed Pump Motor. For slip-ring motor drives the cost of the regulator, heat exchanger and any extra plant required for cooling water should be included. Only the basic price for squirrel-cage motors is required.

Main Feed Pump Turbine. The cost of the turbine should include the control and lubrication services and governor gear.

Main Feed Pump Coupling. In addition to the coupling, the heat exchanger and any special cooling services required should be valued.

Standby (and Starting) Pump(s). For electric motor drives the cost of this item will be the same as that stated for the main pump. For the bled steam and generator coupling drives two half-duty starting and standby pumps have been included for reasons connected with the two-shifting duty specified for C.E.G.B. conventional stations.

Standby (and Starting) Motor(s). Again the cost of motor drives is the same as previously, but two motors and regulators will be required for the other drives.

Standby Feed Pump Coupling. This item is the same as main feed pump coupling.

Piping for Pumps and Turbines. Before any estimate of this item can be included, a layout drawing showing the disposition of the plant in the station is required.

Civil Works. As in the previous item a layout drawing is required before any accurate assessment can be made. This item is intended to cover foundation blocks and also any additional building volume required.

Circuit-Breakers. Two circuit-breakers are required for each type of drive. Even though the breakers for drives 1 and 2 will be for powers over twice those for drives 3 and 4 the difference in price should be relatively small.

Thermal Cost. The steam that is required to drive the bled steam turbine is obtained just before the cold reheat line. This means that instead of 2,900,000 lb/hr of steam being reheated as for drives 1, 2 and 4 the reheater is required to handle 2,600,000 lb/hr, a reduction of some 10 per cent. The capitalised thermal cost of supplying this heat is around £700,000.

Cost of Boiler and Reheater. In order to accommodate the extra steam passing through the reheater for drives 1,

2 and 4 there will be an extra capital cost in the order of £120,000 on the boiler and reheater as compared with one suitable for the lower quantity.

Reheater Piping. Because of the extra quantity flowing to the reheater for drives 1, 2 and 4 the steam pipes to and from the main turbine must be increased in size. The increase may only be an inch on the diameter but it involves an extra cost in the order of £22,000.

Condenser. As the steam passing through the bled steam turbine is exhausted to the heaters and then to the de-aerator, the turbo-generator condenser for the bled steam turbine drive is smaller than the condenser required for the other drives. The difference in price is about £10,000.

Starting Current. As previously stated, the cost of providing an auxiliary electrical supply system suitable to withstand the starting current of approximately six times full-load current, as required by a squirrel-cage motor, is some £20,000 more than for a slip-ring motor.

Sent-out Capacity. A fully-worked-out heat balance shows that after accounting for variations in component efficiencies and cycle losses one is left with gross generator outputs from the plants with either style of electric drive or shaft coupling drive of 513,000 kW and with bled steam turbine drive of 500,000 kW (by definition of the conditions).

The various pump drives require different input powers due to losses in motors, couplings, regulators, etc. The actual powers required are as follows:—

1 and 2	Power required by electric motor driven pump	10,291 kW
3	Power required by bled steam turbine driven pump	9,661 kW
4	Power required by generator shaft driven pump	10,111 kW

The net power to the terminals in kW for these drives is therefore:—

1 and 2	3	4
513,000	500,000	513,000
10,291	—	10,111
502,709	500,000	502,889

The differences in sent-out capacity are:—Generator shaft drive, 2,880 kW more than bled steam turbine drive; electric motor drive, 2,709 kW more than bled steam turbine drive. The extra sent-out capacity when capitalised can be valued (taking the generator shaft drive as datum) as an extra cost of £25,000 for the electric drives and £575,000 for the turbine drives.

Concerning the cost of all capital items except the reheater, piping, condenser and auxiliary supply system it can be shown that the difference in capital cost between the cheapest drive (generator shaft) and the most expensive (bled steam turbine) is relatively small, say £35,000. It is therefore apparent that when these sums are included in the sum total the overall cost of the turbine drive is considerably less than any other.

For the 500 MW set, which is the subject of this article, a bled steam turbine has been purchased, as for all the other 25 sets of 300-500 MW which have been acquired by the Board. The two sets of 275 MW each have been provided with shaft coupling driven pumps, while all the sets of lower rating have electric motor driven pumps. It is as well to state, however, that the difference in total cost between bled steam turbine and coupling drive is almost entirely dependent on the fuel cost and therefore it is easy to see how various other bodies having different relationships between capitalised fuel costs, manufacturers and techniques have been able to make a reasonable case for one or other of these drives.

Electrical Development in Queensland

IN a special report, the State Electricity Commission of Queensland recommends that a power station with a capacity of 360 MW should be built on a site near to the West Moreton coalfields, at an estimated total cost of £36 million. A second station, estimated to cost £49 million, would be needed in Central Queensland, based on Callide coal, since transmission from Southern to Central Queensland is economically impracticable and the cost of transmitted power to the Capricornia region would be greater than that of local generation.

Investigations by the Irrigation and Water Supply Commission have shown that cooling water can be provided in the quantities required for a power station of up to 720 MW capacity on the Callide coalfield by constructing a dam on Callide Creek. If such a dam could be constructed as a multi-purpose irrigation and water supply project, it would make a significant reduction in the future price of electricity in this area. The report adds that in the design of the new power stations consideration should be given to the prospects of utilising natural gas as an alternative or supplementary fuel, should large reserves be discovered.

The Commission also recommends the construction of interconnecting facilities between the areas of the Southern Electric Authority and the Wide Bay - Burnett Regional Electricity Board at an estimated cost of £1·8 million.

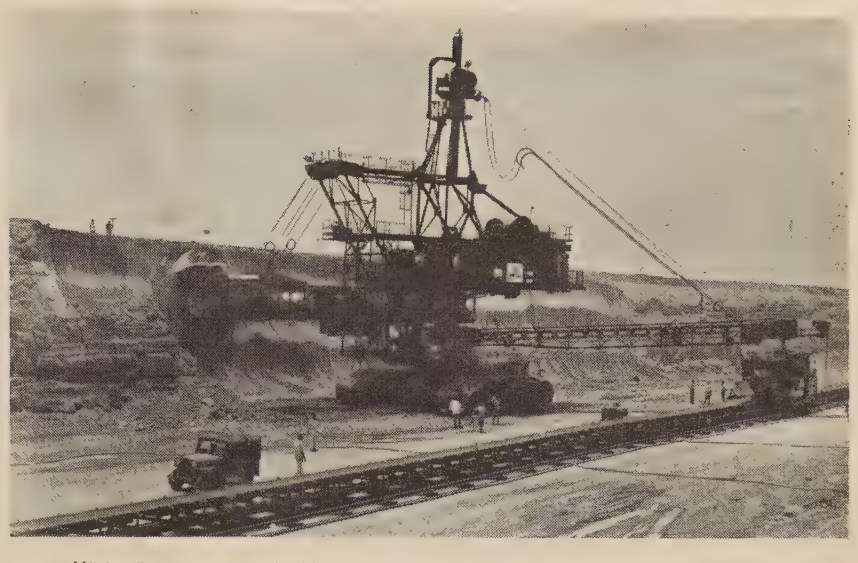
The year ended 30th June last was another period of progress and expansion, especially in extending electricity supply to many rural areas, states the Southern Electric Authority in its annual report. Sales to consumers, at 775 million kWh, showed an increase of over 11 per cent on 1959-60. Installed capacity of power stations remained at 225·5 MW, but the peak load on the system increased by more than 10 per cent to 193·8 MW, and although the reserve power position is satisfactory it has been decided to bring forward the commissioning date of the fifth 30 MW unit at Bulimba "B" to 1962. The new unit will raise the capacity of the station to 150 MW.

A major power station is to be established at Swanbank, a few miles south-west of Ipswich. It will include six 60 MW turbo-alternators and will receive coal from mines in the immediate vicinity, the greater part being delivered directly from the pit-heads to the station bunkers by conveyor belts. The final estimated cost is £33 million.

No major additions have been made to the transmission substation capacity, but a third 60 MVA, 110 kV transformer is expected to be commissioned at Bulimba early in 1962.

NEWS FROM INDIA

FROM A CORRESPONDENT



Mining in progress at the Neyveli lignite field near which a 250 MW power station is to be erected

AN important mining and power project that may change the face of South India is nearing completion at Neyveli, about 120 miles north of Madras, where lignite will form the basis of an integrated energy project for supplying the fuel and power needs of the southern region. Because of the acute shortage of power and fuel in Madras State and the difficulties and cost involved in transporting coal from North India, the Government decided to exploit the lignite deposits at Neyveli, although the total reserves are estimated at 2,000 million tons only, and the deposits themselves occur at a depth of over 180ft below the surface. The mining of these underground deposits is complicated by the existence of artesian water below the lignite which exerts an upward thrust of six to eight tons per square foot. There being no impermeable barrier of sufficient thickness below the lignite bed to withstand the pressure, there is a risk of the water heaving upwards, bursting through the lignite seam and flooding the mine, unless its pressure is kept continuously under control by pumping or other means.

It was therefore decided to adopt open-cut mining and, on the basis of a report prepared by Powell Duffryn Technical Services, Ltd., a project was taken in hand for mining 3·5 million tons of lignite a year and to utilise it for a thermal station of 250 MW capacity; the manufacture of urea equivalent to 70,000 tons of nitrogen a year; and the production of 380,000 tons of carbonised briquettes for domestic fuel purposes. A start on this integrated project was made early in 1957, and regular production of lignite began in September this year. Tests of bulk samples have confirmed the earlier reports on the composition and calorific value of the lignite, 5,500 B.Th.U/lb. The lignite required for the first unit of the power station, expected to be commissioned towards the end of this year, will be made available in time.

Raw lignite is bulky and liable to spontaneous combustion, and can be transported in bulk only in the form of briquettes. Since the most economic use of lignite is to use it as fuel in boilers close to the mine itself, the generation of electric power is the most important constituent scheme in the integrated project. In addition to the installed capacity, the station will have a back-pressure turbine plant for use in conjunction with other units of the project based on steam processing. The power station will require about 1·5 million tons of lignite a year. The station has been designed by Russian engineers and will have five 50 MW sets. The first is now under erection and the entire station is scheduled for completion by early 1963.

The briquetting and carbonisation of the balance of the lignite is expected to yield nearly 400,000 tons of carbonised briquettes, most of which will be used for domestic fuel purposes. They will also be utilised for industrial purposes, the most promising use being for the production of a suitably hard coke in low-shaft furnaces for making pig iron and steel. Preliminary investigations indicate that a plant with a capacity of about 500,000 tons of pig iron per year might be set up in the Third Plan.

Although power from the Neyveli project is yet to be fed into the grid, the expectation of bulk power in large quantities is attracting a number of industries to the region, including electrical manufacturing. But despite the output from Neyveli, the overall power shortage is expected to continue, and plans are being made to set up a nuclear power station with an initial capacity of 300 MW. In addition, reports have appeared in the Press about oil exploration activities in the Cauvery basin which the Government hopes to undertake very soon in collaboration with an oil company. There is also a proposal for installing an oil refinery in the region and, in anticipation of this venture, the Government has decided to encourage a change-over from coal to furnace oil for industrial purposes, as also for the generation of electric power. The cost of the entire integrated project is estimated at Rs. 140 crores,* the cost of the thermal power station being placed at nearly Rs. 40 crores.

First Indian Electric Locomotive

The first electric locomotive to be assembled in India was commissioned by Mr. Nehru on 14th October at the Chittaranjan Locomotive Works, West Bengal, which also makes steam locomotives. All mechanical parts have been

* Rs. 1 crore = £750,000.

made at Chittaranjan, while most of the electrical equipment, representing about 55 per cent of the estimated cost, was supplied by the English Electric Co. Apart from the unit already completed, three others are in different stages of production, and a total of 21 d.c. units is scheduled to be completed in the first batch, for which the electrical machinery and equipment will be supplied by the above company. No authoritative information about costs is available, but it is understood to be in the region of Rs. 14 lakhs (£100,000), as against the price of Rs. 12 lakhs for an imported equivalent.

The Third Plan requirement of electric locomotives has been estimated at 300 and a similar target has been fixed for diesel locomotives. The Chittaranjan works, the biggest in the country, has plans for manufacturing half of this total, the electrical parts being eventually produced in the country, either at Bhopal or in one of the new heavy electrical works to be established in the public sector.

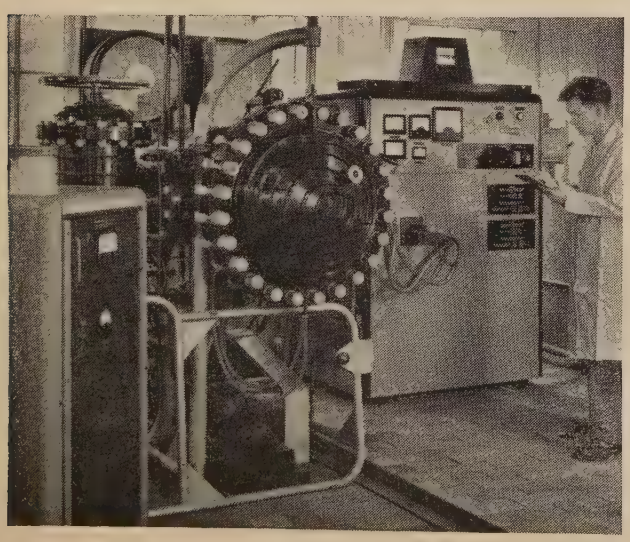
Details of seven major industrial projects, including four electrical manufacturing schemes, have now been announced by the Ministry of Commerce and Industry. The two principal electrical items are for heavy plant production. One, at Ramachandrapuram, near Hyderabad, is expected to cost Rs. 25-30 crores and it has Czechoslovak backing. The other is to be assisted by the Soviet authorities; it will be at Ranipur in Uttar Pradesh and will cost Rs. 30 crores. Another scheme, for the manufacture of boiler plant at Tiruchirapally (Madras State), is also backed by Czechoslovakia; the amount involved is Rs. 15-20 crores. The fourth project is for the production of precision instruments. It will be situated at Kotah (Rajasthan) and will cost Rs. 8 crores.

All these projects, preliminary work on which is already under way, are expected to be completed by 1966 or thereabouts, but full production may not be achieved before 1970. The foreign exchange requirements for carrying out the projects will be met through the financial aid agreements entered into by the Indian Government with the Soviet and Czechoslovak Governments earlier this year.

Induction Furnace for B.I.S.R.A.

A VACUUM induction melting furnace is now in operation at the Sheffield laboratories of the British Iron & Steel Research Association. It was supplied by G.E.C. (Engineering), Ltd., in association with Vacuum Industrial Applications, Ltd., and is being used for research into vacuum melting and casting of ferrous metals, with particular emphasis on the determination of optimum temperatures and pressures necessary for the removal of impurities such as tin, copper and hydrogen. It is also suitable for studying the effect of reduced and elevated pressures on various steel-making reactions, having been designed for operation at pressures up to 200 p.s.i. The furnace is capable of working at a maximum temperature of 1,700°C and has a melting capacity of 10 lb.

To permit easy cleaning of the inner surface, the 24in diameter furnace chamber has been arranged horizontally. A handle penetrates the side of the chamber enabling the charge to be poured into a mould by tilting the crucible.



General view of the G.E.C.-V.I.A. vacuum induction melting furnace installed at the B.I.S.R.A. Laboratories, Sheffield

Six tipping buckets for adding alloying metals to the molten charge have been provided.

A two-stage pumping system comprising a 10in oil booster-diffusion pump backed by a gas-ballasted rotary pump is used to evacuate the chamber. Water-cooled baffle plates protect the pumping ports from radiant heat from the charge. With these pumping arrangements provided, it is possible to reach the minimum working pressure of one micron in about five minutes, and the pumping speed is high enough to maintain this pressure under conditions of severe outgassing.

There are two control consoles, arranged one on each side of the furnace. One of the consoles contains the vacuum equipment while the other houses the high-frequency plant supplied by Radyne. Power for the furnace is supplied by a 27 kW, 10 kc/s generator.

HIRFANLI HYDRO-ELECTRIC PROJECT

POWER from Turkey's longest river, the Kizil Irmak, is now produced at Hirfanli generating station. The construction and commissioning of the scheme was undertaken jointly by two British contractors. At an ordinary meeting of the Institution of Civil Engineers on 19th December a paper on the project was presented by Mr. G. B. Finch, B.Sc.Tech. (senior civil engineer, George Wimpey & Co., Ltd.) and Mr. N. K. Webb, B.A. (resident engineer, English Electric Co., Ltd.).

The authors described the diversion of the river by two tunnels and subsequent plugging work, and discussed details of the dam, spillway, spillway weir and bridge, power intakes and power house. The paper continued with notes on the contract, the organisation and features of the joint work, followed by details of the construction programme. In conclusion, the problems of an isolated overseas contract in labour, services, haulage, concrete production and accommodation were outlined. The principal quantities, electrical features, station protection, and major plant are tabulated as an appendix to the paper.

CANTAT Inaugurated

THE Canadian transatlantic telephone cable (CANTAT) from Oban, Scotland, to Hampden, Newfoundland (section "A") then overland to Corner Brook, Newfoundland, and Grosses Roches on the south bank of the St. Lawrence river mouth (section "B"), was inaugurated on 19th December by H.M. the Queen. Making the first telephone call, the Queen spoke from Buckingham Palace to the Canadian Prime Minister, Mr. J. G. Diefenbaker, in the Chateau Laurier Hotel in Ottawa. She said that the new link was a skilful and highly imaginative enterprise and a splendid example of co-operation between Commonwealth countries. Mr. Diefenbaker referred to the next link which will span the Pacific and connect Canada with Australia and New Zealand. This link would, he said, be connected before the end of 1964. The Queen then declared the cable open and felt sure that it would help to strengthen the ties between the peoples of the Commonwealth.

CANTAT is the first stage of the £88 million Commonwealth round-the-world telecommunication system. The 2,000 nautical mile section "A" of CANTAT is jointly owned by Cable & Wireless, Ltd., and the Canadian Overseas Telecommunication Corporation, while the 400 nautical mile CANTAT "B" is solely owned by the latter. The new type lightweight cable for CANTAT "A" was designed by the British Post Office and manufactured by Submarine Cables, Ltd. (owned jointly by Associated Electrical Industries, Ltd., and British Insulated Callender's Cables, Ltd.). The submerged repeaters were supplied by Standard Telephones & Cables, Ltd. Sections "A" and "B" are connected by 70 miles of underground cable across Newfoundland. The transatlantic circuits are extended from Grosses Roches to Montreal via micro-wave and normal cable systems.

At a Press conference, the Rt. Hon. Reginald Bevins, M.P., the Postmaster General, referred to three interesting points about the new installation. It was, he said, the first to use the new lightweight cable. (Details of this type of cable were given in our 3rd February, 1961, issue.) Due to the development of two-way repeaters suitable for deep water use, a single cable only was used to carry speech in either direction. Thirdly, said Mr. Bevins, it was the first communications cable to be manufactured, laid and owned by participating Commonwealth countries. Over 60 simultaneous telephone calls can be made via the CANTAT link and it thus doubles existing facilities between London and Montreal.

H.M. the Queen inaugurated the new transatlantic cable by making the first telephone call. She spoke to Mr. Diefenbaker in Ottawa

REDUCING SUPPLY INTERRUPTIONS

A New Maintenance Technique

THE number of rural consumers whose electricity supplies have to be cut off during maintenance work on overhead power lines can be greatly reduced by a new technique developed by the Midlands Electricity Board. This live-line by-pass system is based on the installation of devices called "load by-pass isolators" on poles carrying 11 kV lines. Lengths of line can then be removed from the circuit and the load diverted, without interruption, through special polythene-insulated cables laid on the ground.

Upwards of 180 items of equipment have been specially designed and made, with the co-operation of manufacturers, to ensure that the technique can be carried out reliably and safely. Included in the equipment are an aluminium alloy structure on which the by-pass cables can be hoisted from the ground to cross buildings or roads, and protective screening for temporary substations which may have to be established in fields.

A 30 mile section of the 11 kV distribution system in the Evesham District, supplying quarries, farms and villages, was modified for tests of the new technique and a number of operations were successfully carried out, including changing of poles and the addition of a new substation. It was found that use of the by-pass technique reduced by 80 per cent the number of consumers who would have been affected by planned interruptions of supply. Sunday working, normally required when supplies to quarries have to be cut off, was avoided.

The chief engineer of the M.E.B., Mr. G. S. Buckingham, said recently:—"Our distribution system includes nearly 7,000 miles of 11 kV overhead lines and it would be a formidable and costly task to modify all these lines for application of the new technique. We are therefore making a start by fitting by-pass connection points on all new lines now being erected in our Shropshire and Herefordshire Area, where the present rate of construction of overhead line is over 200 miles per year. Training in the new technique has been given to two teams in each of the five districts in the area—Hereford, Leominster, Ludlow, Shrewsbury and Wellington—and units of by-pass equipment have been established at Hereford and Shrewsbury."

ELECTRICAL REVIEW 29 DECEMBER 1961

The Basis of Electrical Engineering

The unified theory of electricity presented in this article avoids the impression given by conventional teaching methods that electricity and magnetism are not closely related. The author developed his treatment of electrical theory as a result of rewriting a lecture course for first-year undergraduates

By KEITH MORGAN, M.Sc.(Eng.), D.I.C., A.C.G.I, A.M.I.E.E.*

IN most developments of electrical theory, four distinct topics are generally considered as separate subjects—electrostatics, magnetostatics, electromagnetism and "current" electricity. Also, within each topic, the various laws are stated as separate entities, thus hiding any underlying pattern. For example, Coulomb's inverse square laws for charges and poles give rise to electrostatics and magnetostatics, while the Work Law, Ampère's Law and Faraday's Law give rise to electromagnetism.

The following presentation of a unified theory[1] brings together in a simple manner, all of the theory normally included at first-year level. It also demonstrates the way in which the various effects of the different topics fit together to form a comprehensive whole without any of the loose ends of conventional treatments. Rationalised M.K.S. units are used throughout. The review is not complete since quantities like voltage, resistance and capacitance have been omitted, but their place in the treatment will be clear.

Ultimately, all electric, magnetic and electromagnetic radiation effects are due to electric charges in various systems of motion, and it is convenient to take Coulomb's Law for static charges as the starting point of the unified theory. Electrostatics can be developed in a fairly conventional manner. Magnetic fields can be shown to be due to charges in uniform motion and those fields can be associated with magnetic poles so facilitating studies in magnetostatics.

This conception of electrostatic and magnetostatic fields as being due to charges at rest and in uniform motion is important, and it leads to consideration of radiation fields as being due to charges accelerating. As sinusoidal currents (a.c.) are charges undergoing acceleration in a particular system of motion, the transformer equation associated with Faraday's Law is subtly different from the flux cutting rule, where only steady motion of charges is involved.

Electrostatics

As previously indicated, Coulomb's inverse square law for the force between electric charges, at a separation r, is taken as the starting point:

$$F_S = \frac{qq'}{4\pi\epsilon_0\epsilon_r r^2}$$

where the constants have to be accepted as part of the rationalised M.K.S. system of units. (See the Table for definitions of symbols.) It should be noted that this law tacitly assumes point charges in an infinite, uniform medium. The relative permittivity of the medium may be defined, using this expression, as the ratio of the forces within a given charge configuration in vacuum to the forces when the charges are "immersed" in the medium.

The force on the charge q′ depends, firstly on the magnitude of the charge q′ and secondly on a set of quantities which may be associated with charge q. These quantities depend on the magnitude of q, the permittivity of the medium surrounding q, the distance from q and some universal constants.

The electric field strength $\mathscr{E}$ about q and due to q is such that the force on q′ in this field is $F_S = q'\mathscr{E}$. (The electric field strength at a point depends on the permittivity of the medium.) It is also possible to describe the field of q in terms of the electric flux density D. This can be introduced by considering a thin conducting sphere of radius r about q having an area $4\pi r^2$. The presence of the charge +q at the centre induces a total charge on the inside of the sphere of −q and, because of the charge separation, a charge of +q on the outside. This corresponds to an induced charge density of $q/4\pi r^2$ or a spherical spread of charge "effect." It is convenient to think of this effect in terms of an electric flux emanating from the charge at the centre and spreading spherically. In the rationalised system of units each unit charge is considered to emit unit flux so $q = \Psi$, and the electric flux density due to q at radius r is $D = \Psi/4\pi r^2$, as would be expected. Combining this with the previous equations defining the electric field strength, it can be seen that $D = \epsilon_r\epsilon_0\mathscr{E}$. Thus, the electric flux density within a configuration is independent of the relative permittivity of the medium provided the latter is infinite and homogeneous, whence Gauss's Law can be proved. This law states that the total electric flux emanating from a closed surface is equal to the charge contained.

From Gauss's Law the force on a thin uniform layer of charge on a conducting surface can be derived[2] as $F = \frac{1}{2}D\mathscr{E}$/unit area. If the principle of virtual work is now applied to a parallel plate capacitor, the energy of the electric field is found to be $W = \frac{1}{2}D\mathscr{E}$/unit volume. By integration, the forces on, and the energy within any system of conductors can be calculated.

When a varying current flows into an ideal capacitor,

* The University, Southampton.

then $i = \frac{dq}{dt} = C\frac{dv}{dt} = \int J dS$ where J is the current-density and S is an element of area. The current appears to cease at one electrode and start again at the other, but if Gauss's Law $\int D dS = q$ is applied to a closed surface which completely encloses one electrode only, it is seen that $i = \int J dS = \frac{dq}{dt} = \int \frac{dD}{dt} dS$ indicating the existence of a "displacement current density" $J = \frac{dD}{dt}$ due to the changing induction within the capacitor, to provide continuity of current flow.

The theories of polarisation, electric dipoles and electric double layers can be developed at this point. The concept of displacement current is necessary to set up Maxwell's equations.

Electrodynamics

In the past few years, the authors of several first-year undergraduate textbooks have indicated that it is possible to relate electrodynamic theory with electrostatic theory by making use of some of the results of the special theory of relativity. Under present-day conditions many students will have met this theory, in some form or other, at school and probably in science fiction as well. The link provided by this theory is valuable and it can be put across in a fairly simple way. It is realised that the full implications of the step will probably not be appreciated, but the effects encountered can be associated with the mass transformation experienced in cathode ray tubes and accelerators.

It is only necessary to quote two results of the special theory of relativity. The first is that charge is independent of the frame of reference. The second that a force F perpendicular to a given direction in a stationary frame of reference transforms into a force

$$\frac{F}{\sqrt{1 - \frac{u^2}{c^2}}}$$

in a frame of reference moving with a velocity u along the given direction (c being the velocity of electromagnetic wave propagation in free space $= 3 \times 10^8$ metres/sec): while a force along the given direction does not change.

This transformation can be applied to the charges in two parallel conductors carrying currents which are flowing in the same direction. In Fig. 1, the positive charges represent the ions of the atoms of the conductors while the electron flow is represented by the negative charges having drift velocities u and u'. All the forces between the

BASIC AND DERIVED UNITS

BASIC UNITS Concept	Symbol	Dimensions	Unit	Equivalent in c.g.s. or f.p.s.
Length	l	L	1 Metre (m)	10^2 cm (3·281 ft)
Mass	m	M	1 Kilogram (Kg)	10^3 gr (2·205 lb)
Time	t	T	1 Second (s)	1 second
Charge	q	Q	1 Coulomb (C)	10^{-1} e.m.u. $= 2{\cdot}998 \times 10^9$ e.s.u.
DERIVED UNITS				
Force	F	MLT^{-2}	1 Newton (N)	10^5 dynes (7·23 pdls = 0·2247 lb wt)
Energy (inc. heat)	W	ML^2T^{-2}	1 Joule (J)	10^7 ergs (23·603 ft pdls = 0·7376 ft lb wt)
Power	P	ML^2T^{-3}	1 Watt (W)	10^7 ergs (23·603 ft pdls/s)
Current	i, I	$T^{-1}Q$	1 Amp (A)	10^{-1} e.m.u.
Voltage, e.m.f., p.d.	e, E, v, V	$ML^2T^{-2}Q^{-1}$	1 Volt (V)	10^8 e.m.u. $= 3{\cdot}335 \times 10^{-2}$ e.s.u.
Resistance	R	$ML^2T^{-1}Q^{-2}$	1 Ohm (Ω)	10^9 e.m.u.
Conductance	G	$M^{-1}L^{-2}TQ^2$	1 Mho (Ω^{-1})	10^{-9} e.m.u.
Capacitance	C	$M^{-1}L^{-2}T^2Q^2$	1 Farad (F)	$8{\cdot}988 \times 10^{11}$ e.s.u.
Electric Field Intensity	$\mathscr{E}$	$MLT^{-2}Q^{-1}$	1 Volt/metre (V/m)	$3{\cdot}335 \times 10^{-5}$ e.s.u.
Displacement or Electric Flux Density	D	$L^{-2}Q$	1 Coulomb/metre^2 (C/m^2)	$2{\cdot}988 \times 10^5$ e.s.u.
Electric Flux	Ψ	Q	1 Coulomb	10^{-1} e.m.u.
Magnetic Field Intensity	H	$L^{-1}T^{-1}Q$	1 Amp/metre (A/m)	$4\pi \times 10^{-3}$ e.m.u. (oersteds)
Magnetic Flux Density	B	$MT^{-1}Q^{-1}$	1 Volt sec/metre^2 (Vs/m^2) = 1 Weber/metre^2 (Wb/m^2)	10^4 e.m.u. (gauss)
Magneto-motive Force, m.m.f.	$\mathscr{F}$	$T^{-1}Q$	1 Amp (A)	10^{-1} e.m.u.
Magnetic Flux	Φ	$ML^2T^{-1}Q^1$	1 Volt sec (Vs) = 1 Weber (Wb)	10^8 e.m.u. (maxwell)
Mutual Inductance	M	ML^2Q^{-2}	1 Henry (H)	10^9 e.m.u.
Self-Inductance	L	ML^2Q^{-2}	1 Henry (H)	10^9 e.m.u.
Permeability of Free Space	μ_o	MLQ^{-2}	$4\pi \times 10^{-7}$ H/m	UNITY
Permittivity of Free Space	ϵ_o	$M^{-1}L^{-3}T^2Q^2$	$\frac{1}{36\pi \times 10^9}$ F/m	UNITY
Velocity of Light	c	LT^{-1}	$2{\cdot}998 \times 10^8$ m/s	$2{\cdot}998 \times 10^{10}$ cm/s
Relative Permeability	μ_r	—	—	same
Relative Permittivity	ϵ_r	—	—	same
Wavelength	λ	L	1 Metre	10^2 cm
Intensity of Magnetisation ($B = \mu_o H + J$)	J	$MT^{-1}Q^{-1}$	1 Weber/metre^2 (Wb/m^2)	10^4 e.m.u.
Polarisation ($D = \epsilon_o \mathscr{E} + P$)	P	$L^{-2}Q$	1 Coulomb/metre^2 (C/m^2)	$2{\cdot}988 \times 10^5$ e.s.u.
Angle	$\alpha\beta\gamma\theta\phi$	—	1 Radian (r)	same
Solid Angle	Ω	—	1 Radian (r)	same
Frequency	f	T^{-1}	1 Cycle/sec (c/s)	same
Angular Frequency	ω	T^{-1}	1 Radian/sec (r/s)	same
Temperature	θ	—	°K °C	same
Resistivity	ρ	$ML^3T^{-1}Q^{-2}$	1 Ohm Metre (Ωm)	10^{11} e.m.u.

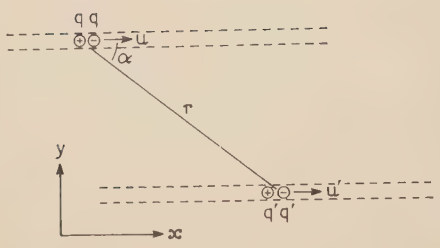


Fig. 1.—Current element in parallel conductors

charges can be determined and it can be shown[3] that the force on $+q'$ due to $+q$ and $-q$ is perpendicular to the conductors and of magnitude $F_S \sin\alpha[u^2/2c^2]$ as (in practice) $u \ll c$. Normally this effect (force on a stationary charge due to a current flowing in a nearby conductor) is neglected.

It can also be shown that the force between the two elements of the conductors is perpendicular to the conductors and of magnitude $F_M = F_S \sin\alpha[uu'/c^2]$ where again (in practice) $u \ll c$ and $u' \ll c$. On substituting for F_S,

$$F_M = \frac{(qu)(q'u')\sin\alpha}{4\pi\epsilon_0 c^2 r^2} \qquad \textit{in vacuo.}$$

The continuous flow of charge from one end of a conductor to the other is equivalent to the establishment of a current given by the relation $qu = Idl$. Hence in a given medium:

$$F_M = \frac{\mu_r\mu_0(Idl)\,(I'dl')\sin\alpha}{4\pi r^2} = (I'dl')B$$

where $\mu_0\epsilon_0c^2 = 1$, B is the magnetic flux density and μ_r the relative permeability which is the ratio of forces between the elements of the conductors in the medium and *in vacuo*. This equation is better known as $F = BIl$.

The magnetic field strength may now be introduced as a quantity independent of the medium by the relation

$$H = \frac{B}{\mu_r\mu_0}$$

This equation has been written in this unusual form, as contrasting $F = q'\mathscr{E}$ and $F = (I'dl')B$ suggests that $\mathscr{E}$ and B are the fundamental vector quantities of the subject. This point is of importance in advanced work.

Writing B in the form $\mu_r\mu_0 qu \sin\alpha/4\pi r^2$ shows that charge motion is required to set up a magnetic field, while from $F = BI'dl' = Bq'u'$, it is seen that charge motion is necessary for the normal method of detecting the field.

Magnetostatics

The above definition of H leads to $H = Idl \sin\alpha/4\pi r^2$ which is the Ampère, Biot-Savart, Laplace, Grassmann or Heaviside expression.[4] Here, simply because it is better known as such to electrical engineers, it will be known as "Ampère's Law." Integration of this expression leads to the value of the magnetic field strength about a long straight wire of $H = I/2\pi r$ and from this the "Work Law" can be justified as $\int Hdl = NI$.

It can be noted that the M.K.S.A. system of units is defined in terms of the force between two parallel conductors, which can be derived as $F = \mu_r\mu_0 II'/2\pi r$ per unit length. Building up the theory of dimensions of electrical units can be carried out in terms of mass, length, time and one electrical quantity. In the M.K.S.A. system this is the unit of current (the ampère), but in the present theory the unit of charge is obviously fundamental, and the older M.K.S.C. system based on the unit of charge can be used much more conveniently. The table (p. 1033) contains the dimensions and c.g.s. equivalents of most of the common electrical units in the M.K.S.C. system.

To transform from current sources of magnetic field to permanent magnet sources it is necessary to utilise the idealised long solenoid having zero leakage. The torque on an N turn plane coil of area a, inclined at an angle α to a uniform magnetic field H, is given by the usual formula $G = I'Ba \sin\alpha$; as couples on parallel coils are additive, the same expression holds for a long distributed solenoid of length l'. In such a solenoid the flux Φ' will be uniform along the length and the torque will be $G = (\Phi'l')H \sin\alpha = M'H \sin\alpha$, where M' is the magnetic moment. Clearly the force on each end of the coil is $\Phi'H$.

Consider two nearby ends of two such long solenoids having fluxes Φ and Φ', and long enough to neglect the action of the remote ends (i.e. theoretical point poles). The field due to Φ alone at distance r is $B = \Phi/4\pi r^2$, if spherical spreading is assumed. The force on Φ' in this field is $\Phi'H$ or $\Phi'B/\mu_r\mu_0 = \Phi\Phi'/4\pi\mu_r\mu_0 r^2$. Similarly to electrostatic theory, a unit pole emits unit flux, so $\Phi = m$ and the force between magnetic poles is

$$F = \frac{mm'}{4\pi\mu_r\mu_0 r^2}$$

Hence, the force on a pole m' in a field H can be written as $F = m'H$.

The last part of the conventional statement of the Work Law can now be developed, by showing that the work done in taking a unit magnetic pole once round a closed path linking a current I is I joules. From the force on a unit pole in a field, the force between parallel pole faces can be derived as $F = \frac{1}{2}BH$/unit area. Also the energy stored in the field can be shown to be $W = \frac{1}{2}BH$/unit volume. Both of these expressions are quite general in their application. The theory of magnetic dipoles and shells can be developed at this point and if desired magnetic potential can be included.

Electromagnetism

The self-inductance of an inductor may be defined as $L = (N\Phi)/I$ in an analogous way to the capacitance of a capacitor $C = Q/V$. Application of the field energy expression, above, to a conventional toroid gives $W = \frac{1}{2}(N\Phi)I$ which can be written as the more familiar $W = \frac{1}{2}LI^2$. The first of these expressions is more important than its neglect would indicate, and it is a perfectly general expression for field energy.

Similarly, mutual inductance can be introduced by $M_{12} = (N_2\Phi_{12})/I_1 = (N_2\sqrt{k}\Phi_1)/I_1$ where k is the coupling coefficient. From the expression $W = \frac{1}{2}(N\Phi)/I$, the energy stored in a mutually coupled pair of coils carrying currents I_1I_2 is derived as $W = \frac{1}{2}L_1I_1^2 + \frac{1}{2}L_2I_2^2 + M_{12}I_1I_2$.

In a series circuit with a battery of e.m.f. E driving a current through a resistor R and inductor L, the energy balance at any instant of time is

$$Ei = Ri^2 + \frac{d}{dt}[\tfrac{1}{2}(N\Phi)I]$$

as $W = \frac{1}{2}(N\Phi)I$, hence $E - L\frac{di}{dt} = Ri = e'$ where e' is the instantaneous effective e.m.f. This solution clearly

shows the introduction of a back e.m.f. $e = -L\frac{di}{dt}$ when the flux is caused to change. Writing in the definition of L gives Faraday's Law $e = -\frac{d(N\Phi)}{dt}$, which in turn leads to the transformer equation $e = -N\frac{d\Phi}{dt} = -Na\frac{dB}{dt}$.

In the treatment considered above only a self-inductive circuit was considered. It can be argued that the change in flux linkages $N\frac{d\Phi}{dt}$ may be produced by a permanent magnet being moved in or out of the coil or by mutual coupling to a second coil in a separate circuit. Consideration of such a circuit leads to a back e.m.f. in the main circuit of $e = -L\frac{di_1}{dt} - M_{12}\frac{di_2}{dt}$ where i_2 is the current in the coil in the second circuit. Clearly the mutually induced e.m.f. is $-M_{12}\frac{di_2}{dt}$. The problems of the sign convention of mutual inductance can be considered at this point.

Derivation of the flux cutting rule from $e = -\frac{d(N\Phi)}{dt}$ above is suspect as this equation was derived on the assumption that the circuit was stationary. Consider an open circuited straight conductor being moved with velocity u perpendicular to itself in a magnetic field which is itself perpendicular to the conductor and the direction of motion. The motion of the free electrons and the ions of the conductor (which are fixed with respect to the conductor) in the field B, sets up forces $F = Bqu$ on these charges directed along the conductor. As the total electronic charge equals the total ionic charge there is no resultant force on the wire. However, the electrons will travel along the conductor in the direction associated with the force acting on them while the ions remain still. This motion of the electrons produces a concentration of positive charges at one end of the conductor and negative charges at the other, thus creating an electric field $\mathscr{E}$. Under steady state conditions, the electrostatic forces oppose and balance the motional forces so that $Bqu = \mathscr{E}q$ or $\mathscr{E} = Bu$. For a conductor of length l, $E = -Blu$, the minus sign being associated with the sign convention used.

This expression is often rewritten in the form $E = -\frac{d(N\Phi)}{dt}$ giving the idea that induction and motional e.m.f. are generated by similar physical action. This view of the mechanisms should be discouraged, but it must be admitted that mathematically the general statement of Faraday's Laws is applicable to both mechanisms. This treatment of motional e.m.f.'s gives a useful introduction to the "Hall Effect."

By suitable differentiation of $E = -\frac{d(N\Phi)}{dt}$, remembering that both field values and circuit shape can alter, it is possible to show that the e.m.f.'s due to the transformer effect and flux cutting are additive.

Reverting to the problem of the conductor moving in the magnetic field, it is of interest to consider the situation when the conductor supplies a current $I = \frac{dq}{dt}$. Such action results in a force $F = BIl$ being set up opposing the motion of the conductor, and work has to be done. The power input associated with this is $P = Fu = BIlu$ while the power output from the conductor is VI, which is simply EI or BluI, showing that if resistance effects are neglected, the generator has constant voltage characteristics for all loads.

REFERENCES

[1] Keith Morgan. *Bulletin of Elect. Eng. Education.* Jan., 1961.
[2] Coulson, C. A. "Electricity," p. 33.
[3] Cullwick, E. G. "Fundamentals of Electromagnetism." "Electromagnetism and Relativity."
[4] Hammond, P. *J.I.E.E.* March, 1961, p. 157.

DOUNREAY FAST REACTOR AT POWER

THE Dounreay fast reactor of the United Kingdom Atomic Energy Authority is just completing a run on power. Starting on 13th November the heat output was increased progressively first to 1 MW and then by steps to 8 MW which was reached on 22nd November. The reactor was run continuously at this power until it was raised to 11 MW on 13th December. According to programme the power was then progressively reduced and the reactor shut down for inspection.

This run followed a period of remedial work to solve gas entrainment problems which had occurred in the cooling system. Confirmation of the success of the measures taken was obtained in a series of low power experiments at the beginning of November.

Three sources of gas entrainment were revealed; the tubes used for guiding thermocouples into the lower coolant header; the control rod mechanisms; and, under peculiar conditions of blockage, certain by-pass circuits. The necessary remedial work has been effected. Modifications have been made to the thermocouple tubes and to the control rods, and liquid metal levels altered. Comprehensive instrumentation has been installed to monitor coolant levels in the by-pass circuits.

Experiments have shown that there is now no significant reactivity change associated with the alteration of coolant flow, an original symptom of gas entrainment. Direct measurement of the pressure coefficient further confirms that no gas is now present even at full flow.

At each step-up in the reactor heat output during the recent power run, experiments demonstrated the stability of the system on power changes. The reactivity oscillator has been in use over the same power range and no sign of instability has been detected. Power coefficients have proved constant over the range 2-11 MW and have agreed with those predicted by calculation. Concurrently with the above work a series of shielding experiments in the top shield of the reactor have given results consistent with those predicted in the design.

New Books

Radio and Electronic Laboratory Handbook. 7th Edition. By M. G. Scroggie, B.Sc., M.I.E.E. Pp. 537; figs. Published for *Wireless World* by Iliffe Books, Ltd., Dorset House, Stamford Street, London, S.E.1. Price 55s.

Previously published under the title " Radio Laboratory Handbook," this new edition has been completely revised and considerably enlarged. As the new title indicates, the techniques discussed are applicable to many fields beyond that of radio. The extensive revision necessary has been due primarily to the growing use of semiconductor devices, including transistors, in modern instrumentation.

Among rewritten sections are those on stabilised power units; indicators, including valve voltmeters and oscilloscopes; crystal-attenuators; the construction of experimental apparatus; and those on manufactured equipment. There are new sections on the testing of transistors, diodes and f.m. receivers, on clip-around and digital meters, and on wow and flutter.

Electronic Measuring Instruments. By H. E. Soisson. Pp. 352; figs. McGraw-Hill Publishing Co., Ltd., McGraw-Hill House, 95, Farringdon Street, London, E.C.4. Price 58s.

This book has been written as an introduction to the use of electronic measurement and control in the laboratory and industry. The first six chapters cover the theory and function of such basic circuits as detectors, amplifiers and power supplies, while the remaining chapters illustrate the function of these circuits in an instrumentation or control system. The basic test instruments used most commonly for measuring current, voltage, power, resistance, impedance, inductance, capacitance and waveshapes are covered in associated groups. In each group the calibration standards needed for establishing the accuracy of the instruments are dealt with, as well as the checking equipment used to evaluate the characteristics of vacuum tubes and transistors.

Since this book is intended to assist the training of technicians and to be used as a textbook in certain junior courses, a comparatively elementary approach has been adopted. In most cases the mathematical presentations are in algebraic and trigonometric terms and where higher mathematics are required the terms employed are explained for that particular application. A number of problems of varying complexity have been included and there are a bibliography and appendices giving the mathematical expansions of total work, instantaneous current and self-inductance and providing a comprehensive list of abbreviations and symbols.—T.R.W.

Lead and Lead Alloys for Cable Sheathing. By S. A. Hiscock. Pp. 361; figs. Ernest Benn, Ltd., Bouverie House, Fleet Street, London, E.C.4. Price 70s.

Hiscock's welcome book is the first ever to deal exclusively with this important subject. Not only the author but the cable industry should be congratulated on the achievement. Publication was arranged by Enfield-Standard Power Cables, Ltd., and it is obvious that the whole industry has given the author the fullest possible support. Without doubt the book will become the standard work of reference for every engineer or metallurgist concerned with lead cable sheathing.

Throughout, the impression received by the reader is of someone writing from first-hand knowledge. This is no doubt due to the author's unique experience, first, working on lead extrusion at the British Non-Ferrous Metals Research Association, whose outstanding work on lead cable sheathing is well known to metallurgists, secondly, as chief metallurgist at a cable works and latterly with the Lead Development Association.

The introductory account of the development of the cable press paves the way to a clear understanding of the later sections dealing with the merits and demerits of different presses, both ram and continuous. The description of presses and machines in current use is particularly well done with good illustrations. Pumps and other ancillary equipment also receive attention.

A chapter is devoted to the important subject of defects which can occur during extrusion and to methods of avoiding them. The increasingly exacting conditions which cables need to withstand nowadays has given rise to considerable research into alloy development and into the effect of extrusion variables on the structure and hence on the creep and fatigue properties of the cable sheathing. Hiscock deals with both these aspects in a very thorough manner.

The final chapter on future developments is disappointingly short mainly because these have been anticipated in earlier chapters. There is an excellent bibliography of 260 references. The price is rather high at 70s, but the book offers value for the money and the illustration and general presentation on high quality paper is excellent.—D.B.

SPIN AND TUMBLER DRYERS

An illustrated survey of the various makes and types of spin dryers and heated tumbler dryers now available will be included in next week's issue of the *Electrical Review*. The survey, in the form of a self-contained detachable supplement, will give details of size, clothes capacity, drum speed, finish, price, purchase tax, etc., as well as the manufacturer or distributor. The next in the series (9th February) will deal with washing machines and wash boilers

BOOKS RECEIVED

Electrical Engineering Materials. By A. J. Dekker. Pp. 208; figs. Prentice-Hall International, Inc., 28, Welbeck Street, London, W.1. Price 42s.

Design Manual for Transistor Circuits. By John M. Carroll. Pp. 381; figs. McGraw-Hill Publishing Co., Ltd., McGraw-Hill House, 95, Farringdon Street, London, E.C.4.

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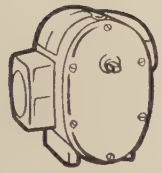

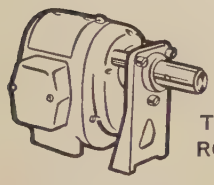

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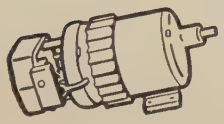

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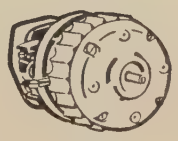

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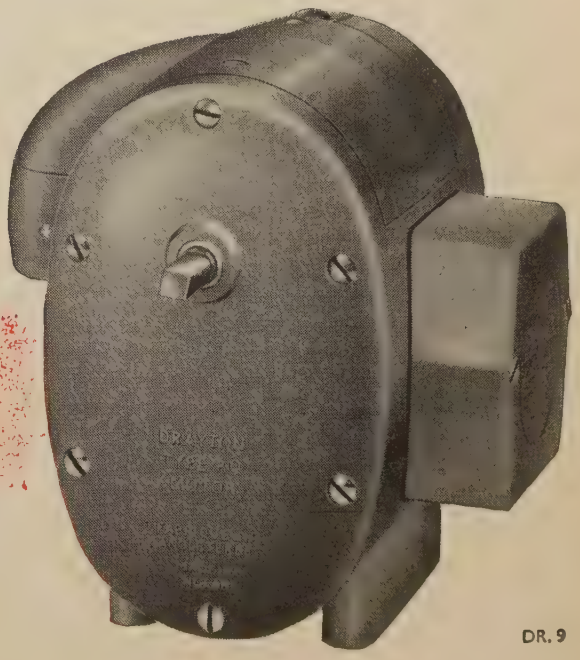

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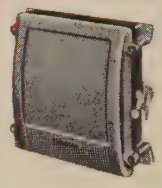

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66.

INDUSTRY AND THE HOUSE

Incomes and Productivity

By AUSTEN ALBU, M.P., B.Sc., A.M.I.Mech.E., M.I.P.E.

ON the Monday before Christmas the House of Commons debated an Opposition motion of censure on the Government for its policies on incomes and productivity. Several previous items of business retarded the start of the debate and curtailed the number of speakers who could take part. One of these items was the delay in laying before the House, in accordance with a custom established by the Labour Government in 1924, the Swiss Loan Agreement. This is a treaty and should be laid for a period of 21 parliamentary working days before it is ratified. As the agreement envisages ratification before the end of the year this was clearly impossible unless, horror of horrors, Parliament were to sit between Christmas and New Year. Needless to say, the Opposition made much of this restriction of the rights of the House and Mr. Gaitskell demanded time for a debate.

This is not the only mistake the Government have made recently in their ordering of business, and on the Tuesday the Secretary of State for War had to admit to another one in his presentation of the Army Reserve Bill. This finally brought Mr. Macleod to the point of announcing in advance the Government's intention of putting the guillotine on both that Bill and the Immigration Bill. This means that debate on them will be curtailed by a time-table; but for the guillotine motion itself the Government will have to allow a day for debate. To have to do this so early in the session is an admission of defeat by the Government on two unpopular measures and the reputation of the new leader of the House has suffered accordingly.

When the House finally reached its main business on Monday, it appeared already to have become suffused with the Christmas spirit: or could it be that speakers in economic debates have lost that fine dogmatic self-confidence that once inspired them? Whatever the reason, the attendance was poor although many of the speeches on both sides displayed a genuine concern for the problem with which every Chancellor has tried to grapple since the war: how to reconcile full employment, stable prices and a free, democratic society.

Wage Pause Criticised

The main interest in the debate was in the new Opposition front bench speakers: Mr. Callaghan as "shadow" Chancellor and Mr. Ray Gunter as "shadow" Minister of Labour. Mr. Callaghan is a popular speaker who mixes aggressiveness and still youthful good humour and he is intelligent and responsible. He started by calling in aid the words of Sir Stafford Cripps who had made the first appeal by a Chancellor that wage increases should go hand in hand with increased productivity in the 1948 White Paper on *Personal Incomes, Costs and Prices*. Mr. Callaghan, like other Labour speakers, attacked the present Chancellor for his wage pause because, in contrast to Sir Stafford Cripps, he had interfered with established negotiating and arbitration machinery and so alienated the Trades Union Congress. Furthermore, as the Minister of Power had warned the miners, even an increase of productivity would not justify a wage increase.

Mr. Callaghan went on to point out the unfairness and illogicality of the pause, quoting a number of industries in which increases had been granted. When he drew attention to a number of Government supporters who were directors of companies which had raised their dividends since the Chancellor's request for restraint, this brought Sir Thomas Moore to his feet to explain that as chairman of a company he had forecast an increase in its total dividend long before the Chancellor announced his pause and had carried out his word. This brought the obvious rejoinder that if the chairman of a private company felt he had to keep faith with his shareholders why should the Government behave differently as they had, for instance, in the case of the Post Office engineers, whose pay award had been postponed.

This exchange led the next day to a spate of "personal statements," which cannot under the rules of the House be debated, by Tory members in the same position as Sir Thomas Moore. Mr. Callaghan wound up by saying that in the economic dilemma they faced they had up to now chosen inflation as the remedy. Any idea that the National Council for Economic Development was to be used to plan or fix wages in isolation from planning the rest of the economy was politically unacceptable to the Labour movement and the T.U.C.

Chancellor's Reply

The Chancellor was at pains to deny that this was his purpose and he to some extent reassured the House by his announcement of the appointment of Sir Robert Shone, of the Iron and Steel Board, as director-general of the Council. Staffs for the lower level of the Council, which will be independent of the Government machine, would be appointed at once. For the upper level he was still awaiting the T.U.C.'s reply to his invitation to join, which he hoped would be favourable because it offered a great opportunity to exercise influence on economic policy at the formative stage.

Mr. Lloyd, in his speech, made an important announcement about the discussions that had been going on in Paris between the Governments to supplement the recourses to the International Monetary Fund. Without giving details, he said that the agreement reached should reinforce international liquidity and help to improve the stability of the exchange markets. He went on to speak of the encouraging opportunities for exports and said the trade gap had decreased from an average of £146 million in the third quarter of 1960 to £35 million in the corresponding quarter of 1961. Our external payments problem was, however, far from being solved.

On the pay pause, the Chancellor said that it was not

a policy for the long term, for which he was convinced that we must try to evolve a national incomes policy. On the immediate future, he said that it would be a negation of policy to bring this phase to an end prematurely. Nor could the pause continue on present lines until a fully-fledged national incomes policy had been worked out with both sides of industry. The general scope for wage and salary increases in the coming financial year would be small. He was inviting representatives of both sides of industry to meet him early in the New Year for consultation about arrangements for this intermediate phase.

Mr. David Price, in an interesting speech demanding more long-term planning, asked the Government to prepare themselves for the job by employing more people with degrees in applied science, natural science or mathematics in the senior ranks of the Civil Service. He did not believe there was a long-term answer to inflation, as was shown by the whole of our economic history. It was towards restraint of inflation that the House should direct its attention.

The winding-up speeches were full of Christmas goodwill. Mr. Gunter appealed emotionally for better industrial relations so that identity of purpose would be restored and the plain facts of the present situation faced together. He said that we had not faced up to the revolution swirling around us. We needed greater mobility of labour. The Government should turn its attention to such problems as redundancy and housing and accept responsibility for the social consequences that flowed from some of these great changes. He went on to criticise the Government's handling of the pay pause and the Chancellor's failure to consult the trade unions on it before he announced it. He wondered whether the Ministry of Labour had been asked to prepare a memorandum on the consequences flowing from the Chancellor's statement. He thought that the Ministry had lost a lot of the honour that it had held in the minds of prominent trade unionists over the past few years and he called on the present Minister to exert his influence to retrieve the position.

The present Minister seemed so overcome with the appeal made to him that he was unable to reply with more than a series of platitudes that could not even take him to the end of the time that he had available.

So on these assurances that we all want the same thing, that there is goodwill on both sides and that the Government will have another try to convince the T.U.C. that a wage pause is not a wage freeze, the last economic debate of 1961 ended. There will be many more in 1962 and in the years ahead.

Electrical Accidents in the Home

A SUMMARY of the fatal electrical accidents on domestic and similar premises notified to the Home Office as having occurred in Great Britain during 1960 has been issued by Mr. S. J. Emerson, H.M. Electrical Adviser to the Home Office. As in previous years, the majority of the accidents were not caused by faulty or poorly-designed apparatus, although there were some examples of this, but by misuse due to negligence or ignorance on the part of the user. The common faults of electrical appliances being taken into bathrooms, single-pole switches connected in the neutral conductor, broken or wrongly connected earth leads and making contact with overhead lines of such objects as aluminium ladders and poles were again prominent. The importance of disconnecting portable apparatus completely after use by withdrawing the plug from the socket-outlet is again emphasised, as is the need for installation, connection and maintenance of appliances to be undertaken only by trained personnel.

The accidents have been classified under various headings. Of the total of 49, eight were due to heaters and fires (three in bathrooms), eight to cables and flexible leads, six to wash boilers and washing machines, five to electric tools such as drills, three each to portable lamps, irons and vacuum cleaners, two each to kettles and radio sets or similar apparatus (one in a bathroom), while blankets, hair dryers, lawn mowers and lampholders accounted for one each. Five were unclassified.

ELECTRICITY IN CYPRUS

THE Electricity Authority of Cyprus, in its ninth annual report, for the year ended 31st December, 1960, states that the development programme, which had to be curtailed in 1957 because of insufficient capital resources, was completed during the year. The Authority's financial position showed no improvement, however, and it therefore became necessary to restrict expansion until further capital was provided. Extensions were made to the h.v. and l.v. lines to meet new irrigation, industrial, commercial, village and suburban requirements. The Authority has drawn up a five-year development programme to enable generating capacity to be increased and supplies to be extended.

The total number of kWh sold was 178·5 million, an increase of 10 per cent over the previous year. There were 8,671 new consumers, mainly on the domestic side. An improvement is also reported in the sales of domestic appliances, 1,386 cookers and 1,679 water heaters being connected (against 1,082 and 850, respectively, in 1959). Domestic development was particularly active in the Limassol district where 754 cookers and 932 water heaters were sold (the 1959 figures were 300 and 169, respectively).

The Dekhelia generating station, completed in August, generated 213 million kWh, and the maximum load was 45,800 kW, giving a load factor of 53·1 per cent.

COMMUNICATIONS SATELLITES

A BRITISH ground radio station at Goonhilly Downs, on the Lizard, Cornwall, is being built to carry out experiments in satellite communications. The station, which will cost about £750,000, will be used for the reception and transmission of telephone, telegraph and television signals across the Atlantic, using satellites to be launched by the U.S. National Aeronautics and Space Administration, commencing in 1962, known as Projects "Relay" and "Telstar." Both involve the active use of satellites launched in elliptical orbits with a maximum height of about 3,000 miles, inclined at about 50° to the Equator. The Post Office ground station is being equipped with radio facilities of an advanced type, including an 85ft diameter steerable aerial capable of being pointed automatically and with great precision in the direction of the satellite. However, many technical, operational and economic questions will require to be studied before a commercial satellite communications system can be established.

VIEWS on the NEWS

By "REFLECTOR"

ON Monday next Mr. R. S. Edwards takes over as chairman of the Electricity Council. If only because of differences of character, a change in command must inevitably bring some change in the day-to-day interpretation of policy, if not in the policy itself. During Sir Robertson King's term of office the supply industry has experienced a period of remarkable technical and commercial development, and he can be well content with the state of the industry as he hands over to his successor. The leading problem at the moment is to determine the extent to which the recent pattern of growth is likely to continue; and if it does, to ensure that financially the industry is in a position to meet the demands that will be made on it. This may mean explaining to consumers the need for higher prices and to the trade unions and the Government the importance of an adequate surplus for reinvestment. For these reasons the industry is fortunate to have as its new head a distinguished economist.

* * *

There has been a prolonged discussion in the newspapers and elsewhere of the Irish Electricity Supply Board's proposal to knock down a row of Georgian houses in Fitzwilliam Street, Dublin, to make way for a new office block. The plan has been (of course) described as "vandalism," but on the other hand it has been contended that the Georgian façade hides inconvenient, insanitary and decaying apartments unfit for human habitation. One Dublin councillor is reported by the *Evening Mail* as saying that

> "Ireland had a Lilac Establishment the same as England. Where they themselves were concerned, they demanded all modern amenities and had no compunction about doing away with old-style buildings when they gained by it. But because a public body was involved they felt entitled to condemn the E.S.B. staff to continue working in dangerous and unhealthy surroundings."

I am puzzled by the term "Lilac Establishment." I thought that this went out with the ending of the "æsthetic" movement about the close of last century.

* * *

Complaints of low voltage are very frequent because of the heavy overloading of distribution systems and difficulties in finding sites for substations and money with which to equip them. None of the grievances has been quite so great as that from the New Haw district of Woking. Here, says the *Surrey Herald,* "instead of receiving the normal national standard of 240 V, their supply gives them an average of only 160-180 V. These people are angry and distressed." Really the position is not so bad as this implies, although bad enough. The area is on the non-standard 200 V declared supply; about 10,000 homes in the Woking area still "enjoy" this. The South Eastern Electricity Board is reported to have said that it had planned *for some years* to build a new substation in New Haw Road. Negotiations were in hand to buy the land and it was hoped that the substation could be built within the next few months, to give the residents an improved supply, and at 240 V.

* * *

An elderly lady at Credwell, Yorkshire, won a television set in a competition. She had no electrical installation in her house and so was offered a battery-operated set. But, she said, that would be no use either "because nearby electricity supplies are so heavy they jam reception." But electricity supplies are becoming "heavy" all over the country so the outlook (or more properly inlook) seems to be unpromising.

* * *

The *Electrical Review* of 27th December, 1901, included a summary of the address by Mr. J. F. C. (later Sir John) Snell as chairman of the Newcastle Section of the I.E.E. In it the following paragraph appeared:—

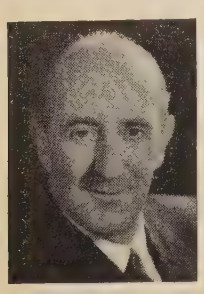
> "Recently there has been much energy displayed in obtaining powers to lay down immense generating stations from which electrical energy is to be transmitted over wide tracts of country. I am convinced that if this development be not carefully considered, it may be a serious matter for the whole industrial position of England. Several extensive power schemes have received the Royal Assent. Where there are a number of small towns, each of which with, say, 10,000 or less inhabitants, and possibly the demand for a network of inter-connecting light railways, it would undoubtedly be a waste of public money to put down separate sets of plant for each little place. In such a case it is probably the most rational method to adopt a station common to them all. But where a town has a population of, say, 20,000 or more inhabitants, it deserves consideration whether it may not be cheaper and better to install a local station, rather than take energy in bulk from a distant one, and then after transformation to distribute it locally. The all-important advantage claimed for these county stations is an improved load factor, but I fail to see how in the same latitude the summation of a number of small peaks is going to result in an improved load curve; and yet upon this factor all depends."

About 19 years later the author became chairman of the Electricity Commission whose job it was to sanction large new stations and encourage interconnection.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

The Minister of Power has appointed **Mr. A. N. Todd,** F.C.A., to be chairman of the East Midlands Electricity Board from 1st January in succession to **Mr. N. F. Marsh,** M.A., M.I.E.E., whose appointment as a deputy chairman of the Electricity Council was recently announced. Mr. Todd was born at Middlesbrough and educated at Bishop's Stortford College. After serving for many years with Deloitte, Plender, Griffiths & Co., chartered accountants, he was appointed assistant chief accountant of the Merseyside and North Wales Electricity Board in 1948, subsequently becoming deputy chief accountant. From 1951 to 1954 he was assistant chief accountant of the British Electricity Authority, leaving to take up the position of chief accountant of the London Electricity Board, of which he became deputy chairman in 1956.



Mr. A. N. Todd

Mr. F. H. Beasant, B.Sc., M.I.E.E., M.I.Mech.E., M.I.Loco.E., has been appointed manager—traction of the Brush Electrical Engineering Co., Ltd., and has now moved from the company's London office to Loughborough to take up his new post. He has been deputy manager since joining the Brush Co. in 1959. After three years at Bristol University, Mr. Beasant joined the Metropolitan-Vickers Electrical Co. in 1931 as a college apprentice engineer. Later he spent a year in Warsaw as the traction engineer responsible for the introduction of Metropolitan-Vickers electric locomotives and motor coaches in Poland and in 1937 he became senior technical assistant for electric rolling stock with the L.N.E.R. During the war he was seconded to the Ministry of Supply, finally becoming manager (engineer) of the Royal Ordnance Factory at Spennymoor, Co. Durham. In 1945 he joined Crompton Parkinson, Ltd., as senior railway engineer, and subsequently became manager of the Traction Division. From 1953 to 1955 he was director and sales manager of the Anti-Attrition Metal Co., Maidenhead, leaving to take over as deputy general manager in Sydney of Crompton Parkinson (Australia) Pty., Ltd., and associated companies.

Mr. Brian D. Hughes has recently joined Crompton Parkinson (Stud Welding), Ltd., as special projects engineer. Before joining the company Mr. Hughes was with W. S. Atkins & Partners, civil engineering consultants, as a design engineer. He is an associate of the Royal Technical College, Salford, and an associate member of the Institute of Structural Engineers and of the Institute of Welding.

Mr. F. W. Tomlinson, M.A., M.I.E.E., F.I.M., has been appointed chairman of Pyrotenax, Ltd., on the retirement of Sir Brograve C. Beauchamp, Bart., who has served for 25 years in that capacity. Mr. Tomlinson was born at Worsley, Lancs., in 1906 and was educated at Clifton College, and Emmanuel College, Cambridge, graduating in 1927 with a Natural Science Tripos. After a period at the National Physical Laboratory at Teddington he joined the Broughton Copper Co., Ltd., Manchester, later absorbed into the Metals Division of Imperial Chemical Industries. In 1938 he was appointed general manager of Pyrotenax, Ltd., becoming managing director later in that year. In 1960 he was appointed to the board of Murex, Ltd., and this year he became deputy chairman. Mr. Tomlinson will continue to hold the position of managing director of Pyrotenax, Ltd., as well as his directorships of the Pyrotenax subsidiary companies in Canada and Australia and of Giles & Elliott, Ltd., New Zealand.

Mr. F. W. Tomlinson

Mr. J. W. Thornycroft, C.B.E., chairman and managing director of John I. Thornycroft & Co., Ltd., raised what he described as a "controversial matter" when he spoke at the annual dinner and dance of the Southern Centre of the **Institution of Electrical Engineers.** He said that the old order when weekly or monthly staff must confine their efforts to design and supervision of installation should be changed. Firms like his own must be allowed to have electrical technicians on the staff who were allowed to touch—in fact to install, test and repair. "Imagine for one moment a staff dentist standing over an hourly paid operative trying to instruct him what to do," he said. The Institution toast, proposed by Mr. Thornycroft, was responded to by Mr. B. Donkin (vice-president, I.E.E.), who said membership had risen since the end of the last war from 70,000 to about 140,000 and within the Southern Centre from 25,000 to 45,000. The guests were welcomed by the chairman, Mr. T. G. C. Harrop.

Mr. L. A. Wingrove has been appointed to the new post of representative in Africa for Crypton Equipment, Ltd., of Bridgwater, a company in the Metal Industries Group. Mr. Wingrove, who will be based in Salisbury, Southern Rhodesia, will be responsible for all sales and service matters and will handle Crypton's complete range of automobile test equipment and battery chargers.

Mr. F. A. Ramage, formerly sales manager of Technical Ceramics, Ltd., has been appointed technical sales manager of Electro Mechanisms, Ltd.

Mr. Donald Laurie has been appointed sales manager of Miniature Electronic Components, Ltd., Woking. Mr. Laurie graduated in electrical engineering at Sheffield University. Before joining M.E.C. just over two years ago he was a sales engineer with the Components Division of Standard Telephones & Cables, Ltd. The appointment of **Mr. Philip B. Bullus** as sales engineer for the North of England is also announced.

Mr. D. Laurie

Mr. John Raymond, M.I.E.E., has been elected to the board of the Fluidrive Engineering Co., Ltd.

Mr. L. J. Ford, M.I.Prod.E., has been appointed general manager, works services, by Creed & Co., Ltd. Mr. Ford joins Creed from the Stanley

Works (G.B.), Ltd., the Sheffield tool makers, where he was chief engineer.

Mr. A. A. Conway has been appointed sales promotion manager of "Servis" Domestic Appliances (Wilkins & Mitchell, Ltd.). Mr. Conway has previously held the position of London sales manager for the "Servis" Home Sales Division.

Mr. A. A. Conway

At the request of the French Government, M. Etienne Hirsch will be succeeded by **M. Pierre Chatenet** as president of Euratom, it was announced by the European Economic Commission last week.

Mr. A. J. Emery, B.Sc., M.I.E.E., home branch administration manager of the General Electric Co., Ltd., and general manager and director, G.E.C. Overseas Services, Ltd., is to retire on 31st December. Mr. Emery received his education at Merchant Taylors' School and University College, London. He joined the G.E.C. in 1929 after post-graduate training and engineering appointments with the Metropolitan-Vickers Electrical Co., Ltd. After holding various posts with the G.E.C. in India, he became managing director of the G.E.C. of India, Ltd., the G.E.C. of Pakistan, Ltd., and the G.E.C. of Burma, Ltd., from 1944 to 1949. In that time he served on the Committee of the European Association for India and from 1946-47 he was a Member of the Bengal Legislative Assembly.

Mr. Emery returned to this country in 1949 as North Western area manager and was appointed general manager of the G.E.C. Domestic Equipment Division on its formation in 1958. In April last year, on the formation of trading groups, he was appointed administrative manager—branch areas, and later in the year was also appointed director and general manager of G.E.C. Overseas Services, Ltd.

Mr. D. Curtis has been appointed sub-area engineer of the No. 7 (Grimsby) Sub-Area of the Yorkshire Electricity Board as from 1st January, 1962. He succeeds **Mr. E. Cockroft,** who has been appointed sub-area engineer in the Board's No. 5 (Wakefield) Sub-Area. Mr. Curtis entered the electricity supply industry in 1941 and held posts with the Norwich and Newcastle undertakings and with the Eastern Electricity Board. He moved to the Yorkshire Board in 1953 in the design section of the chief engineer's department and in 1957 became senior assistant engineer (operation and maintenance) of No. 7 (Grimsby) Sub-Area.

Mr. A. E. Shilling, director, London Electric Wire Co. & Smiths, Ltd., has been elected chairman of the Covered Conductors Association for the forthcoming year. **Mr. J. Large,** general manager, British Insulated Callender's Cables, Ltd., Winding Wires Division, is vice-chairman.

About 130 members of the staff and guests attended the annual dinner of **Wandleside Cable Works, Ltd.,** at the Dog and Fox Hotel, Wimbledon, on 21st December. In reply to the toast to the company proposed by Mr. G. T. Wright, M.I.E.E., chief electrical engineer, India Store Department, Mr. W. L. Wray, managing director, reviewed the company's prospects for the coming year. He said the sales and tonnage had increased substantially in the main company at Wandsworth; the output and production facilities had been doubled in Irish Cables, Ltd.; and the Dunmurry unit, now a wholly owned subsidiary, would soon be in full production. He estimated that by 1963 group sales would be more than doubled. Looking to the future, Mr. Wray said that their agreements with the United States had been extended and there was also a new and most important collaboration with West Germany. The company's order book was most substantial and production facilities are being so developed at home and overseas as to make it possible to become very well diversified. Finally, Mr. Wray thanked the staff of Wandleside for their loyal support. Dancing and carol singing concluded a successful evening.

The **Deco Engineering Co., Ltd.,** recently held its annual dinner at which gold watches were presented to employees who had completed 25 years' service.

Mr. R. Cockshoot, general manager of the Denis Ferranti Co., Ltd., has been appointed a director of the company.

OBITUARY

Mr. L. R. Piper.—The death has occurred of Mr. Leonard R. Piper, who had been the representative of the Midland Electric Manufacturing Co., Ltd., in Scotland for 32 years.

Mr. F. C. Barnett.—The death occurred on 18th December of Mr. Frederick Charles Barnett, chairman of the Wholesale Fittings Co., Ltd., at the age of 79. He was a member of the Council of the Electrical Wholesalers' Federation for a number of years, and was elected president in 1927.

WILLS

Mr. John Innes, C.B., B.Sc., M.I.E.E., former managing director of Cables & Wireless, Ltd., who died on 16th August, left £21,075 gross (£20,510 net).

Mr. A. Waddington, of A. Waddington (Electrical), Ltd., Rochdale, who died on 10th October last, left £24,979 gross (£23,151 net).

Mr. C. M. Kramer, B.A., LL.M., managing director of the Backer Electric Co., Ltd., who died on 27th May last, left £20,124 gross (£16,538 net).

ALUMINIUM WELDING

An enlarged and revised version of their book, "Welding Aluminium," has been issued by Alcan Industries, Ltd., Banbury, Oxfordshire. The new edition makes special reference to the arc-shrouded processes—tungsten inert gas (TIG) and metal inert gas (MIG)—and the tables of procedures, which occupy half the book's 48 pages, apply to these methods. Space is also given to a description of other welding processes—namely metallic arc, resistance, ultrasonic, gas, and pressure welding, also brazing and tungsten-arc cutting—and a section has been added explaining the fundamentals of welding aluminium. Other sections deal with the choice of process and alloy, strength of joints, effect of welding on mechanical properties, distortion, weld inspection, safety precautions, typical applications, and notes on welding techniques.

The tables of procedures have been revised in the light of development work undertaken by the company and its associate, Aluminium Laboratories, Ltd., and new tables have been added to cover both pipe and fine-wire welding. An addition is the inclusion of metric equivalents in all the tables.

Scottish Station Approved

The construction of what will be the largest power station in Scotland has been approved by the Secretary of State for Scotland. This is the 1,200 MW plant projected by the South of Scotland Electricity Board at Cockenzie, East Lothian. It is expected to cost about £50 million.

APPLIANCE SAFETY

Although the Home Secretary hopes to introduce new safety regulations dealing with oil heaters early in 1962, he has at present no plans for making regulations regarding domestic electrical equipment, Mr. David Renton, Minister of State, Home Office, has stated in a written answer.

INDUSTRIAL NEWS

Common Market Problems Examined

MARKETING and standards are two of the most important subjects that require consideration by a company wishing to extend its sales in Europe. Both were dealt with by speakers from the electrical industry at a recent conference organised by the Federal Trust and summaries of their remarks are now published in the printed proceedings of the conference ("Inside the Common Market," price 21s).

Dr. M. K Adler (manager, market research department, Standard Telephones & Cables, Ltd.) points out that marketing in Europe is now a very involved business since our European competitors have developed techniques that are often different from those used in this country. The only way to find out what a customer will want is to go out and ask him; exports must not be regarded as surplus to domestic production. This, Dr. Adler says, applies to industrial as well as to consumer goods, and it is essential that the research and interpretation of the results should be done in conjunction with a sociological expert familiar with the country concerned.

Mr. C. A. J. Martin (executive director, Crompton Parkinson, Ltd.) says he firmly believes that in the present climate of world trade it is vital for the U.K. to take an active and positive part, perhaps in the initiation and certainly in the framing of good international standards irrespective of whether we join the Common Market or not. In making a compromise we may have to concede something less than our traditional ideas on robust quality or higher safety margin, but, Mr. Martin argues, we may exercise our influence to raise somewhat the level of standards in other countries. He also stresses the responsibility, where concessions are made, of users in this country to show willingness to accept the common denominator as expressed in the internationally agreed standard.

English Electric-Prestcold Agreement

THE Prestcold Division of the Pressed Steel Co., Ltd., and the Domestic Appliance Division of the English Electric Co., Ltd., have agreed to manufacture for each other certain domestic electrical appliances and components on a reciprocal basis. This, it is said, will enable both companies to increase still further their growing share of the appliance market and take full advantage of their manufacturing resources. The brand identities of Prestcold and English Electric will be retained and each company will continue to market individually.

G.E.C. TO CEASE WHOLESALING

THE General Electric Co., Ltd., has decided that the group shall drop its own wholesaling activities, and its newly-formed manufacturing subsidiaries are making new arrangements with outside wholesalers. As a result, much valuable property is no longer required by the company and it is therefore disposing of office and warehouse accommodation.

It has already been announced that the company is getting rid of its headquarters building, Magnet House, Kingsway, and is unlikely to return there. It is also offering to let an office block in the centre of Birmingham. An office and storage building in Belfast and a smaller office and warehouse building in Leicester have been put up for sale. The lease of two factory buildings on the Park Royal Industrial Estate, London, is being disposed of, and more buildings are expected to go later.

A statement made on behalf of the company last week said that the concentration of the G.E.C.'s activities in London and the branches up to the beginning of the year is being discontinued, and sales control transferred to the newly-formed subsidiaries at their headquarters. Each will have its own sales force and its own links with wholesalers.

Electricians' Pay Claim

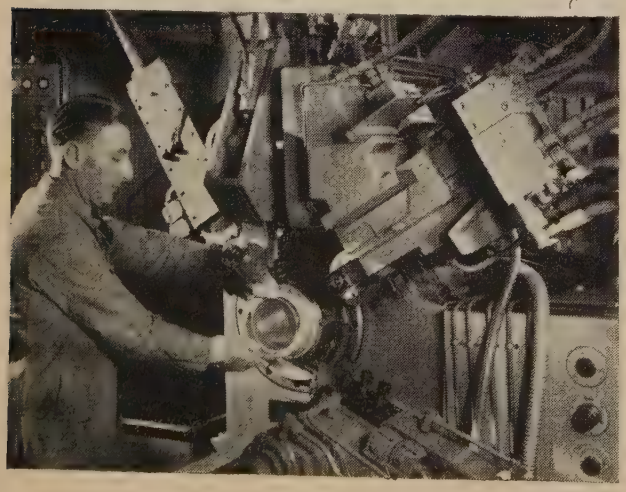
The Electrical Trades Union is seeking a meeting with the National Federated Electrical Association to discuss a review of the wage rates of members employed in the electrical contracting industry. Last January these men were given an increase of 1s an hour under an agreement to remain in force for 2½ years. There was, however, a proviso that if there should be a rise or fall of five points in the cost-of-living index either side could ask for a review. The Union claims that there was a rise of five points between December, 1960, and November last.

Boiler Erectors Dismissed

Over 300 men employed on boiler erection at the West Thurrock, Essex, power station site were given a week's pay in lieu of notice on 21st December. Their employers, Babcock & Wilcox, Ltd., announced that this step had been taken because a substantial number of the employees had consistently imposed restrictions on output and were indulging in "go slow" tactics and other practices which were dislocating production.

New Machinery at A.E.I.-Hotpoint Factory

NEW plant has been installed at A.E.I.-Hotpoint's Llandudno factory at a cost of £140,000 for the production of spin dryer drums for the "Supermatic" washing machine. The accompanying illustration shows the insertion of a zinc balance-ring over the neck of a spin dryer. The machine carries out a flow-turning sequence in which a 17in diameter by ¼in thick aluminium blank is turned to shape and reduced in thickness on side walls to $\frac{1}{16}$in. After the hand fitting of the zinc ring, the machine completes the process by spinning aluminium around the ring, locking it in position.



Final process in the new "flow-spinning" production of spin dryer drums at the Llandudno factory of A.E.I.-Hotpoint, Ltd.

GLASGOW'S NEW ELECTRICITY SHOWROOMS

DESIGNED to serve the 1½ million people in and around Glasgow, the South of Scotland Electricity Board's new showrooms at 74, Sauchiehall Street are among the largest of their kind in Britain. The new building stands on a corner site at the junction of Renfield Street for long associated with the old Lyric Theatre and is in the heart of the city's shopping and entertainment area.

The showrooms were formally opened on 15th December by Mr. Duncan Macrae, the Scottish actor. Other speakers included Sir John Pickles, chairman of the South of Scotland Electricity Board, who presided; Miss Mary George, director of the Electrical Association for Women; and Sir Maxwell Inglis, chairman of the Electricity Consultative Council for the South of Scotland District.

Sir John Pickles said that the growing demand for electricity in the Board's area made such commodious premises not only desirable but essential. Domestic consumption so far this year, he said, was exceeding last year's level by nearly 24 per cent. At the close of the ceremony Sir John Pickles presented an electric toaster to Mrs. Janet Maddison, the first customer.

The building has a total area of 18,500 sq ft on three floors. The ground floor, which has its frontages recessed so that the upper floors form a canopy over its large windows, contains a general display area and the information bureau. The first floor has a section for payment of electricity accounts, a demonstration theatre seating about 200 people, with miniature stage lighting and built-in visual aid equipment, and an area for the display of home laundry equipment. On the top floor there are offices, a 50-seat lecture theatre and a spacious hall for special exhibitions. In the first of these exhibitions, over the Christmas season, nearly 20 of Britain's leading manufacturers presented a festive display of their latest appliances for the home. Among the firms represented were Acme, Belling, Burco, Carron, Electrolux, English Electric, G.E.C., A.E.I.-Hotpoint, Hoover, Kelvinator, William Kemp, Kenwood, Radiation, Revo, Simplex, Tricity, Turner and Wilkins & Mitchell. Also on the top floor is a section which will be used for the display of commercial catering equipment. As the individual units are to be changed frequently, this display is likely to become a constant attraction for hoteliers, restaurateurs and other caterers from all over the South of Scotland.

Throughout the showrooms electrical under-floor warming, automatically controlled by a "Proscontrol" regulator in conjunction with a warmed air ventilating system, provides ideal comfort conditions. Over the entrance doors in Sauchiehall Street, infra-red heaters provide a comfortable welcome to visitors and minimise cold draughts when the doors are opened.

Special attention has been given to lighting and the scheme has been designed to demonstrate as many types as possible in the most effective and attractive ways.

The electrical contractors were James Kilpatrick & Son, Ltd., of Paisley.

The new Glasgow showrooms and, below right, Mr. J. W. Moule (chief commercial officer, South of Scotland Electricity Board); Mrs. Hutton; Mr. Duncan Macrae; Sir John Pickles; Sir Maxwell Inglis; and Mr. William Hutton (deputy chairman, South of Scotland Electricity Board), at the opening ceremony

Applications of Ultrasonics

The application of ultrasonic techniques in a variety of industrial processes is growing steadily. A wide range of current applications, including non-destructive testing, cleaning and machining, are reviewed in a booklet, "Using Ultrasonics," by R. Hamilton. The booklet is obtainable free from the Department of Scientific and Industrial Research Library, State House, High Holborn, London, W.C.1.

NEW ZEALAND ALUMINIUM ROLLING MILL

The first aluminium rolling mill in New Zealand, the £2·5 million Alcan Industries, Ltd., plant at Wiri, Auckland, was recently officially inaugurated by the Prime Minister, Mr. K. J. Holyoake. At the opening ceremony presided over by the company's chairman, Earl Alexander of Tunis, K.G., Mr. Holyoake started a hot aluminium ingot on its journey through the rolling mill, and so in effect opened a new chapter in the history of industrial development in New Zealand. The plant has an initial capacity for the annual production of 5,000 tons of aluminium sheet and plate, and will be able to meet virtually the whole of the country's present requirements of material of this kind.

INDUSTRIAL NEWS *[continued*

Domestic Electrical Appliance Deliveries

DELIVERIES of domestic electrical appliances (other than refrigerators) to the home market during the first nine months of 1961 were nearly 5 per cent higher in value than in the same period last year. In issuing these figures the British Electrical and Allied Manufacturers' Association states that, "although British appliance manufacturers naturally regard this as a disappointing rate of increase, it must nevertheless be viewed against the current economic climate with its continuing hire-purchase restrictions and the 10 per cent purchase tax surcharge introduced in the 'Little Budget,' both of which have undoubtedly had a dampening effect on the demand for major appliances."

The actual value of home deliveries of appliances (apart from refrigerators) amounted to £83·5 million from January to September, 1961, compared with £79·7 million for the corresponding period of the previous year, an increase of 4·7 per cent. Deliveries of the chief appliances are given in the accompanying table.

Although washing machine deliveries held up reasonably well compared with those of refrigerators, the actual numbers were slightly lower this year, the rise of nearly £½ million in their total value being accounted for by the continuing trend towards the twin-tub and automatic models. These increased their share of the total numbers delivered from 49 per cent to 66 per cent.

Home deliveries of electric space heaters were substantially higher this year. Up to September nearly 2·2 million were delivered, compared with 1·7 million last year, and their value showed a corresponding increase of £2·3 million. Other appliances showing rises this year were toasters, up by 56 per cent; hair dryers, 49 per cent; spin dryers, 33 per cent; and food mixers, 28 per cent (percentage increases in numbers delivered to the home market).

The value of export deliveries rose by 7·6 per cent, whilst imports fell by 37 per cent. Imports of refrigerators and laundering machines from West Germany were lower by £2·4 million and those from Italy by £0·6 million. On the other hand, certain appliance imports from other areas increased, notably Canadian cookers, which rose from £161,000 to £250,000, and American dry shavers (also £250,000 this year) which were twice last year's January-September value.

DELIVERIES TO THE HOME MARKET OF DOMESTIC ELECTRICAL APPLIANCES BY U.K. MANUFACTURERS

	1960 Jan.-Sept.		1961 Jan.-Sept.	
	000's	£000	000's	£000
Washing Machines	612	27,171	579	27,569
Refrigerators (electric and other) ...	816	27,755	676	20,957
Cookers 5/12 kW	351	12,455	350	12,938
Space Heaters (up to 3 kW) ...	1,682	6,551	2,164	8,807
Vacuum Cleaners	828	11,457	825	10,918
Irons	1,339	2,271	1,268	2,113
Dry Shavers ...	582	2,193	541	2,161
Blankets	870	2,241	688	1,878

ELECTRICITY OUTPUT IMPROVES

THE Ministry of Power's statement of electricity output in November shows that 12,586 million kWh was generated, an increase of 9·8 per cent —well above the average for the year. From the figures of electricity sent out by the individual Boards it will be seen that the pace of electrical development in Scotland was maintained at over 14 per cent. The highest rates in England were returned by the Boards in the southern half of the country, although Yorkshire still leads for the whole year.

ELECTRICITY GENERATED AND SENT OUT FOR PUBLIC SUPPLY

	Fuel consumed Thousand tons			kWh generated Millions			kWh sent out Millions	Output capacity (m.c.r.) MW
	Coal	Coke and Breeze	Oil	Steam	Water power	Total		
Central Electricity G.B. ...	4,999	84·9	491·9	11,491	16	11,516	10,836	28,170
North of Scotland H.E.B. ...	4	—	1·6	7	311	325	324	1,045
South of Scotland E.B.	377	0·4	0·5	711	34	745	704	1,819
Total for November, 1961 ...	5,380	85·3	494·0	12,209	361	12,586*	11,864	31,034
Corres. total for November, 1960	4,914	73·5	512·6	11,183	269	11,467	10,808	29,191
Inc. or dec., per cent	+9·5	+16·1	−3·6	+9·2	+34·3	+9·8	+9·8	+6·3
Total to date, 1961	47,812	784	4,857	110,476	2,837	113,462	106,736	
Total for corres. 11 months of 1960	44,994	812	4,758	103,809	2,247	106,190	99,946	
Inc. or dec., per cent	+6·3	−3·4	+2·1	+6·4	+26·3	+6·8	+6·8	

* The total figure includes generation by other methods amounting to 16 million kWh.

ELECTRICITY SENT OUT BY BOARDS FOR THEIR CONSUMERS

Board	Totals for November (million kWh)			Twelve Months' Totals Ended 30th November (million kWh)		
	1960	1961	Inc. or Dec.%	1960	1961	Inc. or Dec.%
London	910·6	1,022·1	+12·2	8,871·8	9,421·4	+ 6·2
South Eastern	615·1	693·4	+12·7	6,256·9	6,714·1	+ 7·3
Southern	833·5	935·7	+12·3	8,347·1	9,056·3	+ 8·5
South Western	370·3	416·7	+12·5	3,862·5	4,177·7	+ 8·2
Eastern	981·1	1,093·8	+11·5	9,977·5	10,706·1	+ 7·3
East Midlands*	803·1	877·8	+ 9·3	8,266·2	8,847·5	+ 7·0
Midlands*	1,073·3	1,159·7	+ 8·0	10,923·6	11,531·7	+ 5·6
South Wales*	562·4	566·8	+ 0·8	5,990·7	6,148·2	+ 2·6
Merseyside and N. Wales* ...	609·2	659·3	+ 8·2	6,413·6	6,971·8	+ 8·7
Yorkshire*	1,072·2	1,165·6	+ 8·7	10,718·1	11,855·0	+10·6
North Eastern*	595·6	621·9	+ 4·4	6,073·9	6,491·5	+ 6·9
North Western*	1,036·0	1,120·8	+ 8·2	10,624·8	11,564·8	+ 8·8
Total all Area Boards	9,462·4	10,333·6	+ 9·2	96,326·7	103,486·1	+ 7·4
Direct Supplies by C.E.G.B. ...	315·1	319·1	+ 1·3	3,771·9	3,816·9	+ 1·2
Grand Total	9,777·5	10,652·7	+ 9·0	100,098·6	107,303·0	+ 7·2
Mainly Industrial Areas*	5,751·8	6,171·9	+ 7·3	59,010·9	63,410·5	+ 7·5
Mainly Non-Industrial Areas ...	3,710·6	4,161·7	+12·2	37,315·8	40,075·6	+ 7·4
South of Scotland E.B.	810·9	931·4	+14·9	7,909·0	8,910·8	+12·7
North of Scotland H.E.B. ...	180·0	206·4	+14·6	1,791·9	1,997·5	+11·5

* Those in which industrial consumers took over 50 per cent of the total sales in the preceding financial year.

Telephone Equipment Exhibition

A permanent exhibition of historical telephone equipment was opened by the Post Office at Fleet Building, Farringdon Street (Shoe Lane entrance), on 11th December. It contains examples of telephone instruments, cable sections, switchboards and signalling gear leading up to the most modern equipment and techniques and includes a demonstration of subscriber trunk dialling. The exhibition is open daily (Monday to Friday) from 10 a.m. to 5 p.m.

Permanent Magnet Price Agreement

After hearing thirty witnesses the Restrictive Practices Court, on 20th December, reserved judgment in the case in which it has to decide whether or not the price agreement of the Permanent Magnet Association is in the public interest.

cable buying?

Tired of dealing with a bureaucracy — want to deal with a business? — PLACE YOUR NEXT CABLE ORDER WITH PERMANOID. You'll realise your potential custom matters to us from the moment you make your first call — you'll be greeted with cordiality, not with a request for a computer reference. Begin trading with us and you'll find that delivery enquiries about Non-Standard Cable can be answered 'on the spot' by your PERMANOID Branch Manager or H.O. Sales Clerk—you won't be buffeted between factories or involved in a 'Round Britain' quiz. Turn to PERMANOID if you're suffering from 'purchasing frustration,' you can take the first step NOW by adding our name to your 'Tender List.'

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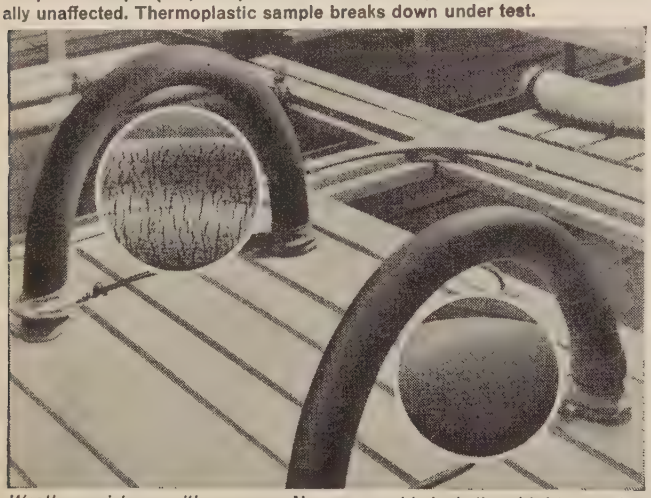
Branches at LONDON, BRISTOL, NEWCASTLE, GLASGOW, WOLVERHAMPTON & DUBLIN

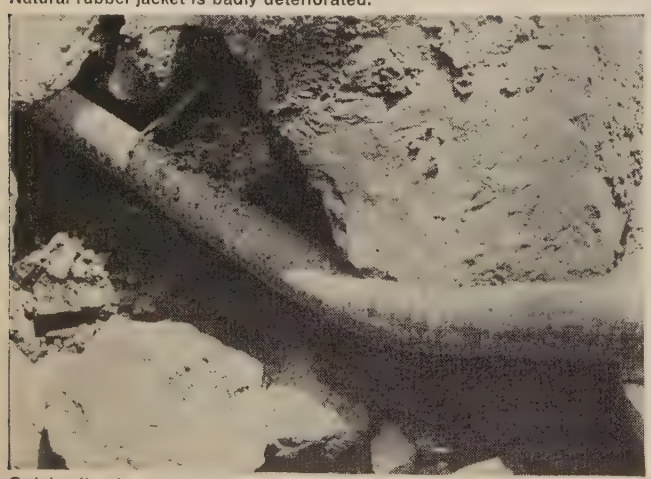
HGP/PG1

G

No plastic flow with neoprene. It is vulcanized, does not revert and flow. Neoprene sample (left) compressed 8 hours at 75 psi at 302°F. was practically unaffected. Thermoplastic sample breaks down under test.



Weather resistance with neoprene. Neoprene cable jacketing (right) remains lively and tough after continuous exposure to sun and weather since 1935. Natural rubber jacket is badly deteriorated.



Outstanding impact resistance with neoprene. Tons of jagged rock caved in on this 5,000 volt cable. Its neoprene jacket was practically undamaged and power continued to flow.

Du Pont neoprene jacketing for all-round resistance

Du Pont neoprene's reputation as jacketing for wire and cable has been earned by over twenty years of tough and varied service. Its outstanding performance is based on a combination of properties unequalled by any other jacketing material. Du Pont neoprene offers balanced resistance to all the causes of deterioration — weather, sunlight, ageing and wide temperature variations; flame and ozone; oil and grease; many organic and inorganic chemicals; soil acids and galvanic action . . . as well as severe impact, abrasion and cutting.

Specify and use Du Pont neoprene — its time-tested record is your guarantee of all-round protection and long-term economy.

Chemical resistance with neoprene. In direct-burial installations neoprene protective jacketing prevents deterioration of the lead sheath due to galvanic action and chemical corrosion.

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DU PONT NEOPRENE

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

Distributors Du Pont Company (United Kingdom) Ltd., 76 Jermyn Street, London SW1

Du Pont Company (United Kingdom) Ltd.,
76 Jermyn Street, London, SW1, England.
Electrical Review — 12/61 — G.8.
Please send me booklet A7122 telling how Dupont Neoprene protects wire and cable.

NAME_____

POSITION_____ COMPANY_____

ADDRESS_____

CITY_____ COUNTRY_____

INDUSTRIAL NEWS *[continued*

Home and Overseas Orders

TWO overseas orders obtained by the Heavy Plant Division of Associated Electrical Industries, Ltd., cover germanium rectifier equipments with a total installed capacity of 59 MW for aluminium smelters in Australia and Norway.

Crompton Parkinson, Ltd., has received an order worth £100,000 for electric motors from Rumania. The contract was obtained through Lyddon & Company for a large paper mill at Calarasi, near Bucharest: the mill is said to be the largest of its kind in the world, using straw as a raw material. Over 400 motors are to be supplied, ranging from ½ h.p. to 1,000 h.p., totally-enclosed or splash-proof. They will be required for the preparation plant and other duties.

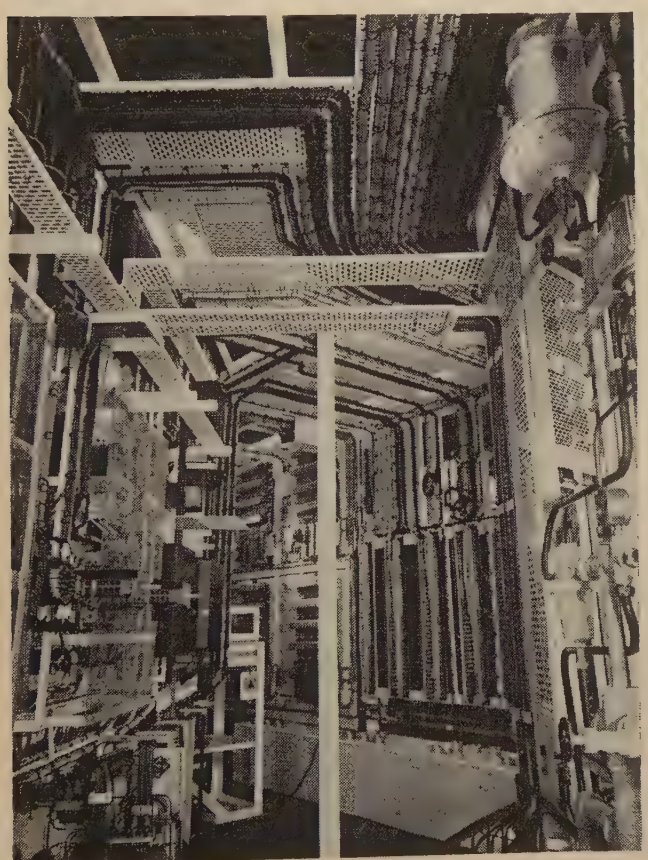
The Bradford Dyers' Association, Ltd., has placed an order with W. H. Allen, Sons & Co., Ltd., for turbo-generating equipment for one of their subsidiaries in the dyeing industry, the Standish Co., Ltd., Wigan. The plant will comprise two 800 kW geared, back-pressure turbines, each driving an Allen 3·3 kV alternator at 1,500 r.p.m. through an Allen-Stoeckicht epicyclic speed-reduction gearbox.

Enfield - Standard Power Cables, Ltd., has received a further order from the C.E.G.B., valued at £133,000, for the supply and installation of 275 kV pipeline compression cable at Dungeness nuclear power station.

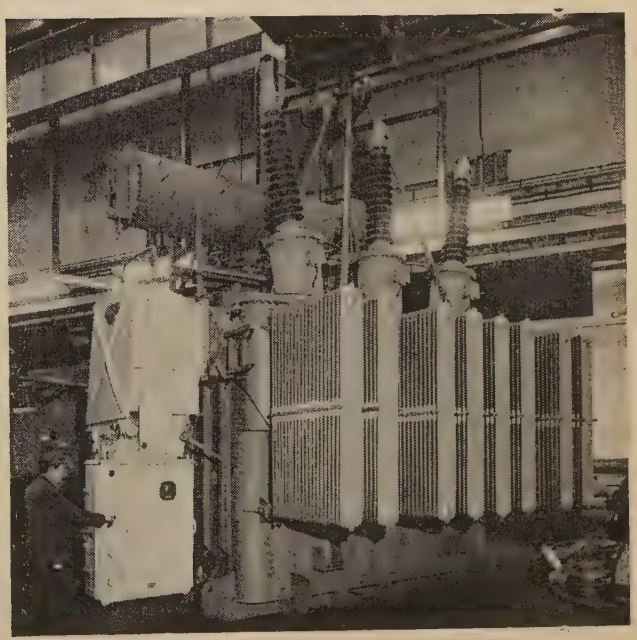
The Electrical Apparatus Co., Ltd., has received an order for 24 cubicle and multi-motor contactor panels to control the air conditioning system of the new Kai Tak Airport Terminal, Hong Kong.

The Automatic Telephone & Electric Co., Ltd., has received orders from the Canadian National Railway Company and the Canadian Pacific Railway Company totalling nearly $450,000. They are for transistorised CM type telephone and broadcast channelling equipment for use on radio bearer circuits between Moncton, Halifax and Sydney, and Moncton, Quebec and Montreal. This equipment reinforces existing open wire line routes and caters for future expansion in these areas.

Elland power station, in the North Eastern Region of the Central Electricity Generating Board, recently took delivery of a Bray BL.460T 110 h.p. tractor shovel supplied by the area distributors, William G. Search, Ltd. The shovel is of British design and construction, with a 3 cu yd bucket, and its use is expected to result in economies in coal handling



The automatic boiler control system at Uskmouth "B" power station is being supplied by George Kent, Ltd. The illustration shows the instrumentation wiring behind one of the control panels. Uskmouth "B" was fully described in the Electrical Review *of 19th May, 1961*



The first of two 14 MVA generator transformers for export to Nigeria has recently been completed at the Heaton Works of C. A. Parsons & Co., Ltd. Both are for the Electricity Corporation of Nigeria's Afam power station, where they will step up the generated voltage of 11 kV to 132 kV for transmission to the Port Harcourt and Aba substations. Included in the contract are two 10 MVA transformers for the substations

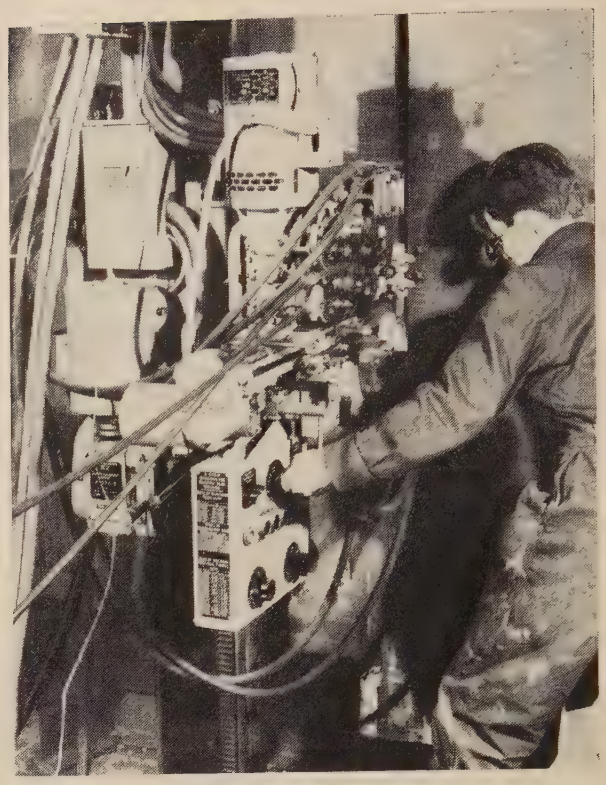
INDUSTRIAL NEWS *[continued*

ELECTROSLAG WELDING

FOR the longitudinal seams of the heat exchangers for the Dungeness nuclear power station electroslag welding is being used by Head Wrightson Teesdale, Ltd. The welding machine used is of Russian manufacture. It was purchased via Esab, Ltd., who are also supplying the welding wire and flux being used. The shell plates of the heat exchangers are between $2\frac{15}{16}$in and $3\frac{3}{8}$in thick in steel to B.S. 1501-161, Grade C. Each tier consists of four plates, i.e. there are four electroslag welds per tier, and is furnace normalised after the completion of the electroslag welding.

There are six tiers to a heat exchanger and the circumferential welds joining together the electroslag welded tiers will be made by submerged-arc welding. All the welds are subjected to 100 per cent radiography, and in addition ultrasonic inspection will be carried out on all welds in plate thicknesses greater than $3\frac{1}{2}$in.

The completed heat exchangers will be 75ft long by 23ft 6in internal diameter. The design code is B.S. 1500 and the working pressure 295 p.s.i., the temperature being 420°C at the gas inlet end falling to 342°C at the outlet end.



Russian electroslag welding machine used in the construction of the heat exchangers for Dungeness nuclear power station

Research Establishment to Close

Nearly 100 employees are affected by the decision of the Plessey Co., Ltd., to close one of its research establishments at Havant, known as Leigh Electronic Development, Ltd. An official statement issued on behalf of Plessey's, who have a number of research units in various parts of the country, states that the majority of the staff involved are in the process of being transferred to other parts of the organisation.

Contract Price Formulae

The British Electrical and Allied Manufacturers' Association has issued the figures for its contract price adjustment formulæ. The rate of pay for adult male labour effective since 26th December is deemed to be 213s 6d. The "costs of materials" figures are: For electrical machinery and equipment the Board of Trade index figures published on 15th December are 184·3 (1949=100) and 118·8 (1954=100); both figures are provisional. For turbo-generating and allied plant: Materials used in mechanical engineering industries 192·8 (1949=100) and 128·3 (1954=100); both figures are provisional. Blast furnaces and iron and steel melting and rolling (1948 S.I.C. Ref. 40/41) 191·7 (1949=100) and other steel goods, excluding tubes (1958 S.I.C.), 130·6 (1954=100). The price of $\frac{3}{4}$in o/d 18 s.w.g. brass condenser tubes (*Metal Bulletin*, 15th December) was $49\frac{3}{8}$d/lb.

Pumps for Clyde Dry Dock

Pumps capable of emptying the new Clyde dry dock of 40 million gallons of water in less than $2\frac{1}{2}$ hours are to be made by Drysdale & Co., Ltd. There will be three electrically driven axial flow pumps of 60in bore with a combined pumping capacity of 255,000 gal/min. When a large ship is in the dock the emptying time can be reduced from $2\frac{1}{2}$ to $1\frac{1}{2}$ hours. The normal time for filling will be $1\frac{1}{2}$ hours, though in an emergency two of the pumps can work in reverse to augment the flow. In addition to the dewatering pumps and automatic electrical control equipment, the full contract undertaken by the company includes drainage, boosting and ballasting pumps.

SEMICONDUCTOR DEVICE GUIDE

THE development of semiconductors is such that the Electronic Valve and Semiconductor Manufacturers' Association have produced a new edition of the booklet, "The Use of Semiconductor Devices." Its aim is to help equipment designers to make the best use of new devices now coming on to the market. It is also a useful quick-reference manual for teachers and students of electronic engineering, explaining many of the essential design parameters that are required. Recent developments such as tunnel diodes, controlled rectifiers, variable capacitance devices and micro-wave diodes are described, and four-layer two-terminal switching devices are dealt with, including broad descriptions of their construction and application.

Practical advice is given on the acceptance of temperature ratings and there is a section devoted to the theoretical design of heat sinks. This includes a table of thermal resistivity for various materials. New sections include those on heat sinks, mechanical standardisation, parametric and microwave diodes and controlled rectifiers.

The 64-page booklet is being distributed to industry, technical colleges and schools by members of the Association. It can also be obtained from the VASCA headquarters, Mappin House, 156-162, Oxford Street, W.1, price 2s post free in the U.K.

MIRRLEES CHANGE OF NAME

As from 1st January the name of Mirrlees, Bickerton & Day, Ltd., will be changed to Mirrlees National, Ltd., and with effect from the same date the undertakings of the National Gas & Oil Engine Co., Ltd., Ashton-under-Lyne, will be transferred to the renamed company.

The activities carried on at the premises of the National Gas & Oil Engine Co., Ltd., will continue, but communications in respect of services and supplies for the Ashton works should be addressed to Mirrlees National, Ltd., Hazel Grove, Stockport, Cheshire. All correspondence and orders for spare parts for both factories should be addressed to the Spare Parts Division, National Works, Ashton-under-Lyne.

TRADE ANNOUNCEMENTS

The Wandleside Warren Wire Co., Ltd., of Dunmurry, Northern Ireland, is now a wholly owned subsidiary of the Falks Group. Mr. and Mrs. J. R. Cook are no longer members of the board of that company, which was previously 51 per cent American. The technical aid agreement with the American companies has been both widened and lengthened. Mr. W. L. Wray remains managing director of the three cable companies.

The **A.E.I. Lamp & Lighting Co., Ltd.,** has closed its southern sales region depot at 90, St. Aldate's, Oxford, and all business will in future be handled from the Reading depot. The address is 5, Richfield Avenue, Reading, Berks. (telephone: Reading 53257/9).

A new company, **Bladite, Ltd.,** has been formed within the Castrol Group to undertake the removal of the silica deposits which form on turbine generator blades and diaphragms. The registered offices of the company, as well as of Metal Cleaning, Ltd., another Castrol subsidiary, which cleans ancillary turbine equipment, are at 2-8, St. Johns Road, Bootle, 20, Lancashire. At first the services of the company will be confined to the North of England.

P. H. Jackson & Co., Ltd., have moved to 1, Chandos Road, Highgate, Birmingham, 12 (telephone: Victoria 5084).

George Kent, Ltd., announces the appointment of the following area representatives:—Mr. K. A. Steele, A.M.I.Mech.E., Outer London; Mr. J. C. Barrett, Surrey, Kent and Sussex; Mr. G. H. C. Lynn, A.M.I.E.E., Staffordshire and the northern half of Birmingham; Mr. J. E. Brown, Worcestershire, Warwickshire and the southern half of Birmingham; Mr. D. E. Harvey, Manchester, including the eastern halves of Lancashire and Cheshire; Mr. R. Barclay, western half of Scotland; and Mr. Millar Taylor, eastern half of Scotland.

The address of the new London office, showroom and warehouse of the **Lewis Spring Co., Ltd.,** is 153/155, Mitcham Road, Tooting Broadway, S.W.17 (telephone: Balham 8215/6).

B.I.C.C.-Burndy, Ltd., who make all types of electrical connections, from multi-pin electronic components to clamps for busbars and high voltage overhead lines, have now become established in larger premises on the Parr Industrial Estate at St. Helens (telephone: St. Helens 6251). This change was necessitated by the rapid expansion which has taken place in all fields of the company's activities since its formation in September, 1959.

The Facit Carousel memory, high speed tape reader and tape punch, manufactured by Facit Electronics AB, Sweden, are now available from the **A.E.I. Electronic Apparatus Division,** sole agents for this equipment in the United Kingdom and the Commonwealth (except Canada).

Acquisition by Elliott Bros.

Elliott Brothers (London), Ltd., has acquired for cash the capital of Palatine (Surbiton), which for some time has supplied companies in the Elliott-Automation group, principally the Rotameter Manufacturing Co. and Elliott Nucleonics. The business will continue to be managed by Mr. F. W. Broughton, managing director, and Mr. J. G. Kiernan, also a director. Mr. H. G. S. Rogers, a director of Rotameter, and Mr. J. C. Nutter, a director of Elliott Nucleonics, have joined the board.

DIESEL ENGINE CATALOGUE

A fifth edition of the British Diesel Engine Catalogue has been produced for the British Internal Combustion Engine Manufacturers' Association by Temple Press, Ltd., Bowling Green Lane, London, E.C.1, price 52s 6d. The main section, which deals with manufacturers' descriptions of their products, comprises more than 250 pages and deals with some 2,500 engines of a power range extending from 1·5 to 24,000 b.h.p. Technical data include an account of oil engine working principles, definitions of technical terms and concise versions of various British Standards applying to compression-ignition engines and the fuels which they consume. Other features include an explanation of the standard method of cylinder identification and a discussion of the terms used in connection with liquid fuels and the tests which are applied to them. A section deals with the power required for various drives and another gives a simple explanation of methods of de-rating engines to suit particular applications and/or operating conditions.

Strachan & Henshaw's New Headquarters

This office building is the new headquarters of Strachan & Henshaw, Ltd., manufacturers of mechanical handling plant and nuclear fuel charging equipment. It adjoins the company's Ashton works in Bristol. The move of administrative and design staff to the new offices will enable more room to be made available for production at the St. Philip's works

WOODS' NEW MAGAZINE

Woods of Colchester, Ltd., have published the first issue of a bi-monthly magazine, *Fanfare,* printed in English, French and German. It describes applications of the company's products at home and overseas and gives details of new products and general activities of the company in the export field.

Calendars and Diaries

Crofts (Engineers), Ltd., show examples of their gear units, couplings and drives in their 1962 calendar.

The neat diary received from the Brush Electrical Engineering Co., Ltd., has a soft maroon binding with a pocket for holding a season ticket.

Useful information on the company's products and details of sales offices and subsidiary companies are included in the diary sent to us by the Cressall Manufacturing Co., Ltd.

NEW ELECTRICAL EQUIPMENT

MULTI-WAY CONNECTOR BOX

A five-way connector box for phase or neutral connections has been added to the range of single-pole connector boxes produced by Associated Electrical Industries, Ltd. The box, list No. 43815, is suitable for conductors up to 0·06 sq in. There are knockout diaphragms at each entry, with two incoming diaphragms at the bottom of the box and three outgoing at the top. The connector block is of tinned brass with bell mouthed conductor entries and two brass pinching screws for each conductor. A clearance of $\frac{1}{2}$in is provided between the knockouts and the connector block. The moulded case, dimensions $2\frac{1}{8}$in long by $3\frac{3}{4}$in wide by $1\frac{7}{16}$in deep, can be sealed if required. The connector box is available from the Distribution Equipment Sales Department, A.E.I. CABLE DIVISION, 145, Charing Cross Road, London, W.C.2.

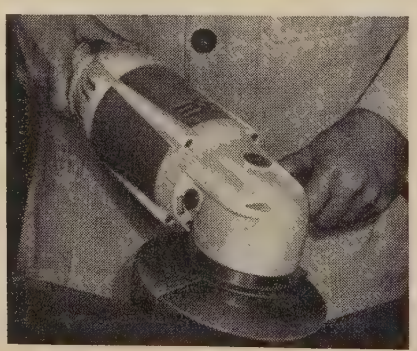
VARIABLE GEAR DRIVE

The RZG variable gear drive unit announced by JONES & STEVENS, LTD., P.O. Box 35, Eastern By-pass, Littlemore, Oxford, incorporates a 50 W input shaded pole motor, which can be wound to any voltage between 6 and 260 V a.c., with a mechanical stepless drive with two output shafts, one providing a speed variation of 110-1,700 r.p.m. and the other shaft offering one of five possible speed ranges, namely, 3-45 r.p.m., 6-95 r.p.m., 9-140 r.p.m., 12-190 r.p.m. and 15-235 r.p.m. An indicator dial is incorporated. Where lower speed shafts are required it is possible to provide an extra gear reduction offering one of twenty different speed ranges down to as low as 0·0013-0·02 r.p.m. The output torque of the unit varies from 21 lb-in, at 10 r.p.m., to $1\frac{1}{4}$ lb-in, at 300 r.p.m.

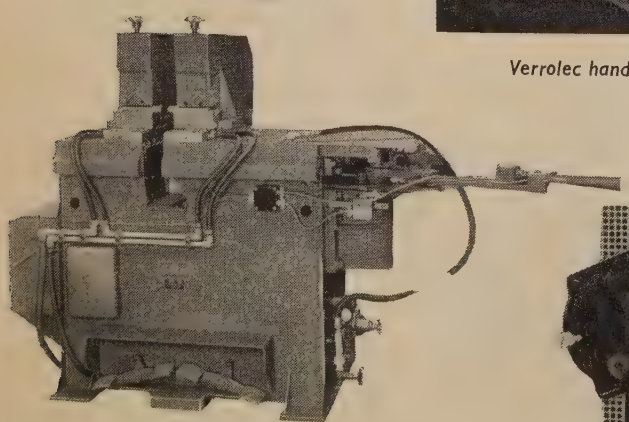
Jones & Stevens variable gear drive

HAND GRINDING TOOL

The hand angle grinder type MSF 676 now available in the United Kingdom from VERROLEC, LTD., 721, North Circular Road, Cricklewood, London, N.W.2, can be fitted with a range of accessories for such jobs as removal of risers and casting funnels; or polishing over straight or curved sheet metal, with a rotary rubber disc and abrasive fibre wheel. A single-phase universal motor is fitted, having a normal rating of 1·25 h.p., air cooled and radio interference screened. According to type, the motor can be geared from 4,300 to 8,400 r.p.m. The tool weighs about 15 lb.

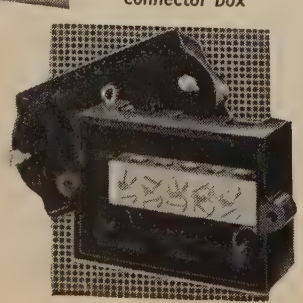


Verrolec hand grinding tool



Electro Mechan-Heat general purpose welder

A.E.I. five-way connector box



MEDIUM POWER WELDER

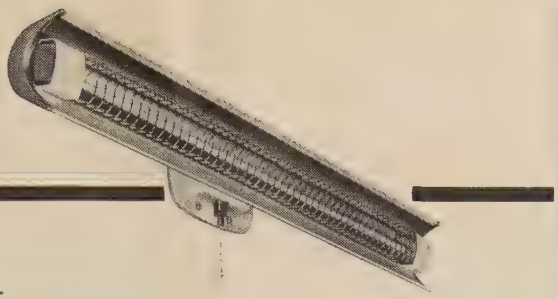
The SBA 51 hand-operated flash or butt welder, made by ELECTRO MECHAN-HEAT, LTD., Manor Works, Ettingshall, Wolverhampton, Staffs., is a semi-automatic machine with pneumatic clamping. Overall dimensions of the equipment, which weighs 1,960 lb, are 67in wide by 39in deep by 55in high. Its nominal rating is 50 kVA with a peak upsetting power of 90 kVA. The single-phase 220 V, or 400/440 V 50 c/s, transformer has a water-cooled secondary with five primary tappings whereby the power can be varied between 30 kVA and 90 kVA.

Tubes up to 1·55 sq in, flats up to 1·86 sq in and bars up to 2·48 sq in in cross-sectional area can be welded. For rings and frames these cross-sectional areas must be reduced by 30 per cent.

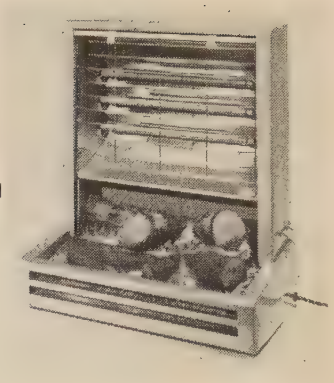
The clamps operate vertically, exerting a pressure of approximately 3 tons on a cylinder pressure of 71 p.s.i. The piston movements from two 4in bore pedal-activated cylinders at the back of the machine are transmitted by levers to the clamping mechanisms. Clearance between the water-cooled copper jaws of the clamps can be adjusted by hand screws over a distance of 2·36in.

The moving table is controlled by a hand lever and quadrant assembly. Various rates of burn-off can be set on the quadrant, which is graduated in millimetres. Adjustments to a connecting arm at the base of the hand lever alter the upsetting pressure, which can be varied between 2 and 3 tons for a force of 88 lb applied to the lever. Initial clearance between the two tables is adjustable between 0·57 and 4·7in.

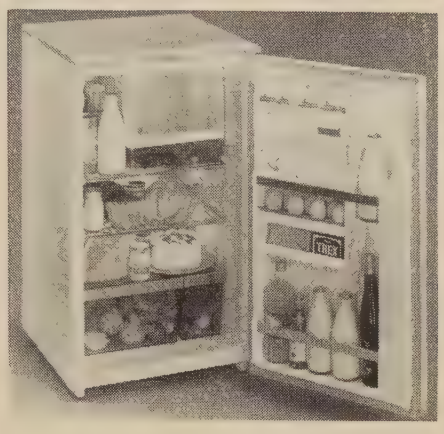
Welding current is controlled through a heavy duty two-pole magnetic contactor, the current being initiated by a trigger on the traversing



Thermair "Silglow" wall-mounted infra-red heater



Morphy-Richards "Solway" 3 kW log-effect fire



Philips 5 cu ft "Snow Queen" refrigerator

Lesser "Leamington" coal-effect fire

hand lever. Any number of pre-heating strokes can be made to bring the workpieces up to welding temperature. When the arm of the hand lever reaches the pre-setting pointer on the burn-off quadrant, the welding current is automatically cut off. There is a blow gun for the removal of flash between welds. The transformer is protected by copper and phosphor-bronze screens.

INFRA-RED HEATER

A new low-priced infra-red heater has been introduced by THERMAIR DOMESTIC APPLIANCES, LTD., Izons Lane, Oldbury Road, West Bromwich, Staffs. Known as the "Silglow," it has a loading of 750 W and is fitted with a d.p. pull switch. The overall length is 27½in, the depth 3½in and the maximum wall projection is 4⅛in. It has a hinged polished aluminium reflector and other parts are finished in cream or white stoved enamel. Models are available for 200/220 or 230/250 V a.c. only, and the price is £3 14s 11d plus 15s 1d purchase tax in the United Kingdom.

PHILIPS REFRIGERATORS

With the introduction of two new refrigerators, PHILIPS ELECTRICAL, LTD., Century House, Shaftesbury Avenue, London, W.C.2, enter the major domestic appliance market for the first time. The refrigerators are to be marketed in the spring under the name of "Snow Queen" and are in 3 cu ft and 5 cu ft sizes. The larger refrigerator has 9 sq ft of shelf area and costs 67 gns and the price of the smaller model, with 5 sq ft of shelf area, is 47 gns, both prices including purchase tax.

Apart from their smart squared-up styling, special features of the new refrigerators include a zero freezer—cold enough to store frozen foods for months; a defrosting tank that fits into the chiller drawer enabling defrosting to be carried out without removing the contents of the main cabinet; and movable door shelves.

The cabinets have one adjustable shelf plus an extra commodity shelf, and an interior light. There is also a roomy chiller drawer under the freezer compartment and the larger model has twin salad crispers. The door has a special compartment with a stainless steel dish to hold ½ lb of butter, as well as built-in egg racks, and milk bottle storage. It is available for either left- or right-hand opening, opens within the cabinet width, and has a magnetic seal.

For ease of movement, the "Snow Queen" is fitted with four rollers. The finish is in white or cream stoved enamel and table tops, in heat resistant "Formwood" obtainable in a natural woodgrain finish, yellow, blue, grey or red, cost 3 gns extra. The dimensions, including the table top and handle, are 33¾in high by 19in wide by 19⅞in deep (3 cu ft) and 36in high by 21in wide by 25in deep (5 cu ft).

FUEL-EFFECT FIRES

The 2 kW "Solway" coal-effect electric fire introduced a few months ago by MORPHY-RICHARDS (CRAY), LTD., 50, Conduit Street, London, W.1, has now been joined by three further models—a 2 kW log-effect, a 3 kW coal-effect and a 3 kW log-effect. The 2 kW models have separately switched 1 kW rod type elements, while the two switches of the 3 kW version control one and two 1 kW elements respectively. The flickering log or coal effect can be used without switching on the heating elements.

All are available in a choice of two colours—hammer finished pearl grey or charcoal—with the fireback in flame red. Both the reflector and the fire-guard grille are chromium plated. The heaters are 22in high by 20in wide by 11in deep and are designed to stand in front of the fireplace. Holes in the base enable them to be installed on the hearth as a permanent fixture.

The price of the complete range of "Solway" heaters is as follows:—2 kW coal-effect, model SOL/20/C, £10 13s 6d plus £2 2s 4d purchase tax; 2 kW log-effect, SOL/20/L, £11 6s 7d plus £2 5s tax; 3 kW coal-effect, SOL/30/C, £11 13s 3d plus £2 5s 11d tax; 3 kW log-effect, SOL/30/L, £12 13s 5d plus £2 8s 6d tax.

The "Leamington" coal-effect electric fires now being marketed by DAVID C. LESSER & CO., LTD., 510a, Coventry Road, Birmingham, 10, are available with both 2 and 3 kW loadings. Separately switched 1 kW rod type elements are fitted and the reflectors are of chromium plated brass. The "coal" is made of washable glass fibre and there is a realistic flame movement. The fires are finished in either gold, bronze or silver and the respective prices are £12 19s 9d and £14 12s.

Engineering in Europe

ABSTRACTS FROM FOREIGN TECHNICAL JOURNALS

SINCE laminated paper is a compression moulding, its mechanical and electrical characteristics have preferred directions, i.e. they are anisotropic. This renders the testing of these materials for withstand strength parallel to the laminations, or paper web, difficult, according to the D.I.N. method, because it would also require the breakdown voltage in this direction to be determined and when plate electrodes are applied to the specimen surface, flashovers take place through the transformer oil surrounding the specimen rather than punctures of the material. No proper test, as specified in D.I.N. 7736, can therefore be carried out.

A new test procedure is suggested by the authors. It is referred to as the slot method, so called because two slots are made in opposite faces of the specimen by a circular saw, each to the depth of seven-eighths of the thickness of the material. The spacing of the slots is 10 mm along the surface. Into these slots the electrodes are introduced. For laminated paper used for transformer insulation a testing temperature of 105°C is chosen since the maximum temperature of the copper conductors is assumed as 115°C and a temperature difference of 10°C between the bracings and conductors is reasonable. The specimens are dried for 96 hours in an oven, and are kept 50 min at the test temperature in the transformer oil prior to the test proper. The paper then demonstrates the statistical method of evaluating the test results. Curves of the mean withstand times and confidence limits are then shown as ultimate results.—" Determination of the Withstand Voltage of Laminated Paper (Hardboard) Parallel to the Direction of the Paper Web," by W. Pohl and G. Lägel, *Elektrie,* Vol. 14, No. 9, pp. 309-312, September, 1961, in German.

Circuit-Breaker Testing

The introduction of this paper surveys the possibilities and limitations of indirect testing methods as against direct testing in power systems, which is virtually impossible, or on experimental lines. The two test circuits considered are the only ones in actual operation, viz. the Weil-Dobke circuit of the A.E.G. h.v. breaker testing station in Kassel and the Kaplan-Nashatyr circuit designed and operated in the h.v. department of the Leningrad Polytechnical Institute. The circuits are similar, the essential difference being that the first takes the supply for the current circuit from a short-circuit generator and the second from a resonant circuit operated at the commercial frequency.

The main advantage of the second circuit is the smaller financial investment required, since the short-circuit generator is omitted. There are, however, further advantages with this circuit. All the elements installed in the circuit contribute to raising the output available for testing. The circuit-breaker tested operates in the h.v. circuit which in its parameters approaches fairly closely the system it is meant to represent; this operation lasts from the instant of opening the back-up breaker to the current zero. Further, the current curve is less distorted than that in the Weil-Dobke circuit (more precisely, this curve has only one break as against the two in the curve of the W.-D. circuit). The arrangement of the spark gap in the K.-N. circuit also enables the capacitor bank for controlling the restriking voltage to be charged before the test, this again resulting in a greater output available for the test.—" Indirect Dual-Frequency Testing Methods for H.V. Circuit-Breakers," J. Panek and V. Novotny, *Elektrotechn. Obzor,* Vol. 50, pp. 415-422, No. 8, August, 1961, in Czech.

Motor Controller Breaking Capacity

The V.D.E. Regulation 0660 stipulates two testing methods for motor contactors, one with test motors and one with a test circuit, the latter being much more severe. The restriking voltage processes at the pole clearing first when disconnecting a locked squirrel-cage motor were investigated to demonstrate the differences in the severity of the two tests. From the oscillograms obtained on motors from 2·5 to 22 kW, it follows that the restriking frequency rises from 28·8 to 55·5 kc/s with the motor rating. The amplitude factor is independent of the rating and varies from 1·35 to 1·54. The mean rate of rise of the restriking voltage increases with rating from about 20 V/μsec to 33 V/μsec.

The values for the mean rate of rise are lower according to the oscillograms than the theoretically presumable values, since clearance does not occur at the natural current zero corresponding to the power factor on short circuit, but before the zero. The excessive severity of the tests in the V.D.E. test circuit, which also varied between individual circuits, is due to insufficient damping of the transient process, leading to an amplitude factor of 1·8-1·85. By contrast, the damping in a test circuit corresponding to the I.E.C. Recommendations is too high, the restriking voltage rising as a consequence aperiodically with a very small slope to the value of the recovery voltage. An improved test circuit is suggested for the preparation of new regulations. This has a shunt resistance and shunt capacitance added to the elements of the V.D.E. circuit. For the design of these two elements a mean rate of rise of the restriking voltage of 50 V/μsec, theoretically independent of the switchgear characteristics and with an amplitude factor of 1·5, is suggested. Oscillograms obtained with this testing circuit show that the improved test circuit puts on the switchgear tested approximately the same stresses as a test motor.—" Critical Remarks on Tests of the Breaking Capacity of Motor Controllers and Contactors," by H. Mau, *Elektrie,* Vol. 14, No. 9, pp. 288-295, September, 1961, in German.

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review.*

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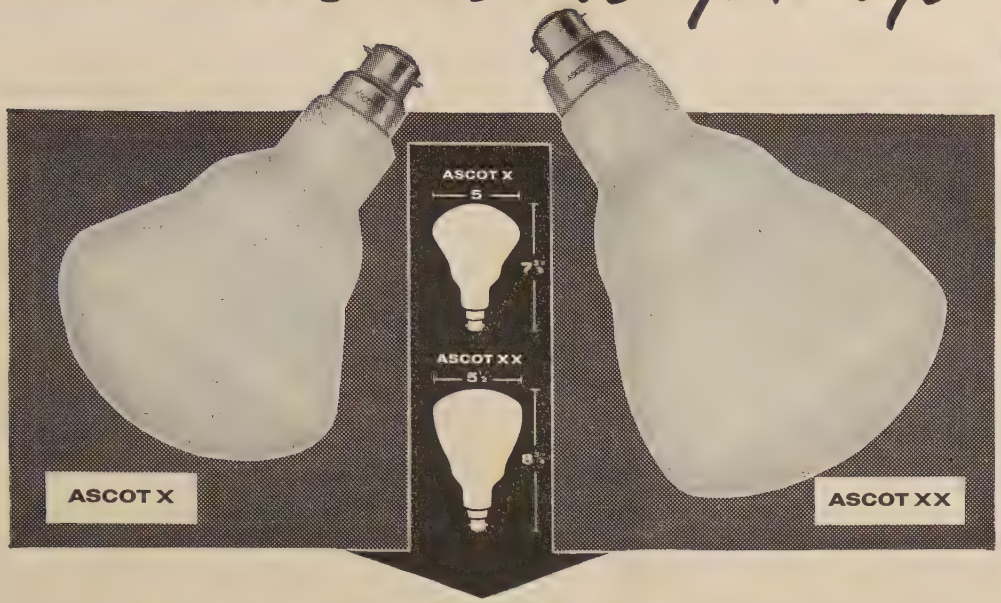

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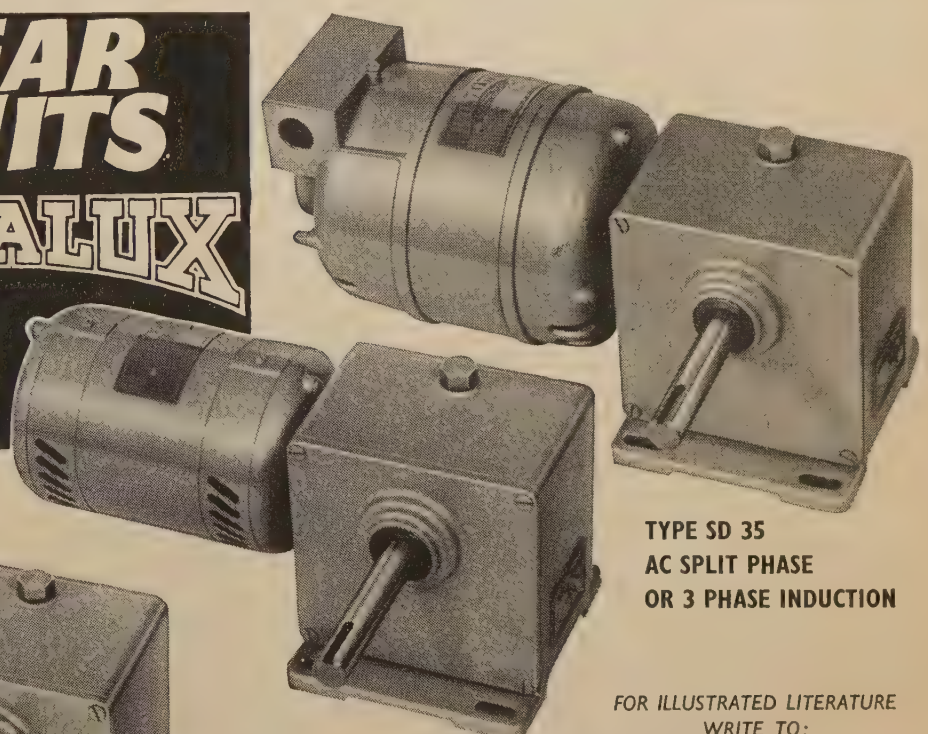

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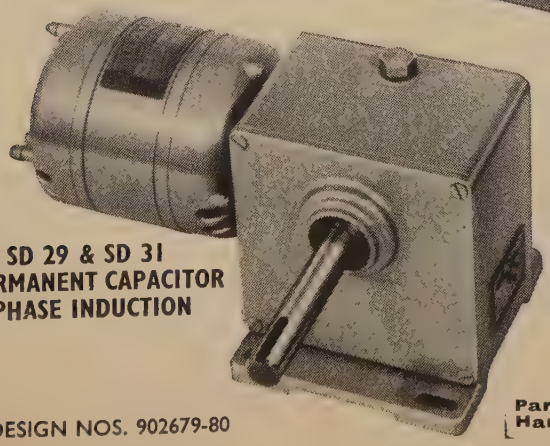

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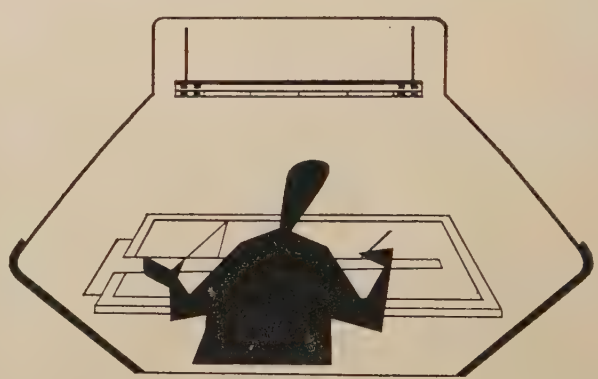

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Emergency Supplies for the B.B.C.

PROVISION OF MAINS FAILURE GENERATING SETS

To ensure continuity of electricity supply for essential services, the British Broadcasting Corporation has recently installed three Paxman mains failure generator sets in a new building at Portland Place and is to install a further 14 sets from the same range in stations situated in various parts of the country. These sets are of the same type and manufacture as those employed for standby duties by the G.P.O. in many of their general service stations or for television duties.

One of the three diesel-generator sets at Broadcasting House is driven by a 12-cylinder engine and the others by eight-cylinder models; all are arranged to run in parallel with one another and with the mains supply. As the sets are in a building containing technical apparatus it is essential that the level of exhaust and mechanical noise should be kept as low as possible. A number of features and safety devices are provided to ensure that any potential hindrance to smooth mechanical operation is immediately identified.

Power Units

Basically, each set comprises a Paxman RPH, vee-form diesel engine directly coupled to a single pedestal bearing generator of Electric Construction Co. manufacture and resiliently mounted as a single unit on a fabricated steel combination bedplate. The generators have ratings of 100 kW (8RPH) and 150 kW (12RPH) at 415/240 V, three-phase, four-wire, 50 c/s when running at a speed of 1,000 r.p.m. for the eight-cylinder sets or 750 r.p.m. in the case of the 12-cylinder set.

The mains failure detection equipment and electrical and mechanical remote control gear were provided under a separate contract to the specification of the British Broadcasting Corporation.

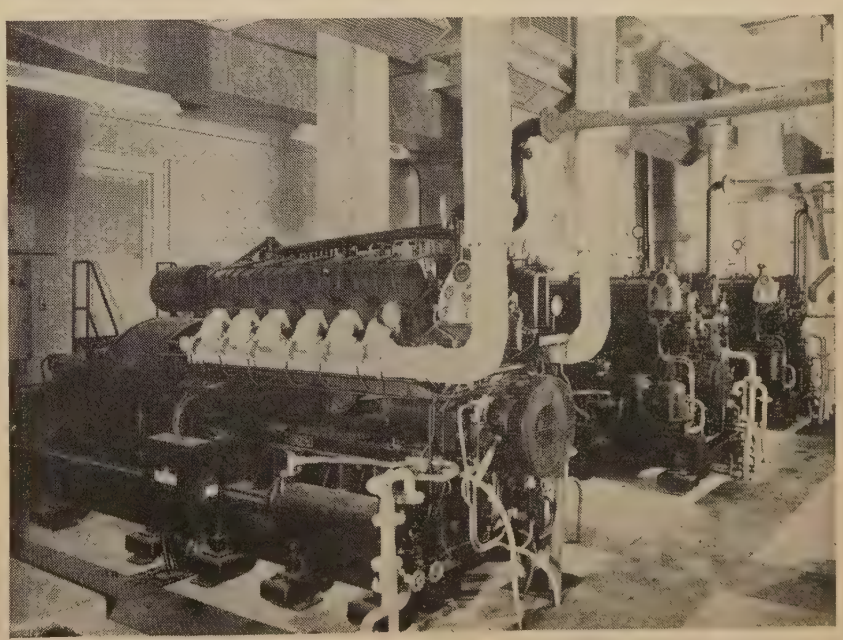
Two of the sets are arranged to start automatically in the event of mains failure or, alternatively, by pushbutton if required; the remaining set is non-automatic. The automatic sets are arranged to start within 15 seconds of a break in the mains supply. In all cases starting is effected by a battery-energised starter motor engaging a toothed ring at the drive end of the engine. The 12-cylinder engine employs two starting motors, electrically interlocked to ensure that both are engaged when full power is applied. Automatic disengagement of the starter motors is by means of a centrifugal switch driven from the free end of the exciter shaft which disconnects the starting circuit when the engine fires and accelerates to operating speed.

The lubrication system is regularly primed by the B.B.C.'s engineering staff in readiness for an emergency. This is by means of an independent control of the lubricating oil pump motor which can be switched on prior to and without starting up the main engine. Thermostatically-controlled immersion heaters heat the sump oil to the correct operating temperature.

When the engine is stationary, coolant is maintained at a constant temperature of 75°F by means of thermostatically-controlled immersion heaters (one per cylinder bank). The open circuit water cooling system employs a single fan type water cooler and make-up tank for both the automatic sets and this system comes into operation, irrespective of whether one or two engines have started, as soon as the generator has attained rated capacity.

Governing

Governing requirements are that speed variation from full load to no load and vice versa shall not exceed 3 per cent permanent and 6 per cent momentary variation as measured by a frequency meter connected to the alternator output supply voltage, with the generator under automatic control. Such requirements are met by the Ardleigh 306 governor which operates in the normal fashion on the fuel injection pumps. The specified voltage is maintained by an automatic voltage regulator. There is provision in the voltage control for making a switch from " manual " to " automatic " while the set is on load.



Three Paxman standby diesel-generator sets at the B.B.C., Portland Place, London. The generators have been supplied by the Electric Construction Co.

NEW PATENTS — Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (4s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

1956

36924. Associated Electrical Industries, Ltd.—Air- or gas-blast circuit-breakers. (882816.) 36925. Switches and circuit-breakers. (882817.) 36927. Dashpots. 3rd March, 1958. (882818.)

1957

100. Laurence, Scott & Electromotors, Ltd., and Schwarz, K. K.—Excitation systems for self-excited alternators. 25th February, 1958. (882976.)

3368. Electric & Musical Industries, Ltd.—Direct voltage stabilisers. 31st January, 1958. (882994.)

5287. Sangamo Weston, Ltd.—Electrical control or measuring systems. 21st January, 1958. (882995.)

9639. Associated Electrical Industries, Ltd.—Earth leakage protection systems for electrical circuits. 17th March, 1958. (883023.)

13571. Associated Electrical Industries, Ltd.—Capacitor voltage dividers. 21st April, 1958. (882941.)

15601. Associated Electrical Industries, Ltd.—Electrical apparatus for intensifying images. 16th May, 1958. (882978.)

22680. Associated Electrical Industries, Ltd.—Rectifier electric welding arrangements. 19th June, 1958. (883052.)

34116. Plessey Co., Ltd.—Heat resistant dielectrics. 31st October, 1958. (882944.)

36993. Mullard, Ltd.—Cathode-ray devices. 7th November, 1958. (882866.)

38258. General Electric Co., Ltd.—Coding apparatus for electrical telemetering systems. 26th November, 1958. (883055.)

1958

2810. Kollsman Instrument Corporation. —Automatic electrical system for cabin pressurisation. 28th January, 1958. (882786.)

3143. Philips Electrical Industries, Ltd.—Pulse converting circuit arrangements employing transistors. 30th January, 1958. (882980.)

3361. Mullard, Ltd.—Circuit arrangements including charge storage tubes. 11th November, 1958. (882799.)

5209. Inductosyn, Ltd.—Rotary position measuring transformer. 18th February, 1958. (882821.)

5997. Walsall Conduits, Ltd.—Mounting for electric switches. 25th February, 1959. (883175.)

6384. Mullard, Ltd.—Electrical delay lines. 27th February, 1958. (882997.)

6675. Officine Galileo S.p.A.—Electric power meters. 3rd March, 1958. (882749.)

6710. Kollsman Instrument Corporation. —Cabin pressurisation system using a.c. power. 3rd March, 1958. (882787.)

13882. National Research Development Corporation.—Electrical measuring instruments. 1st May, 1959. (883109.)

14313. Blanchet, J. M.—Plug or adaptor for an electrical installation. 5th May, 1958. (882908.)

18063. Submarine Cables, Ltd.—Power supply equipment for submarine cables. 29th May, 1959. (883073.)

18668. Heraeus G.m.b.H., W. C.—Electric arc furnaces operating under vacuum. 11th June, 1958. (883015.) 18670. Electric arc vacuum furnaces. 11th June, 1958. (883016.)

19844. Philips Electrical Industries, Ltd. —Magnetic trigger circuit arrangements. 20th June, 1958. (883017.)

21237. Varian Associates.—Electrical vacuum pump and vacuum gauge apparatus. 2nd July, 1958. (883189.)

22034. Philips Electrical Industries, Ltd. —Single sideband speech transmission systems. 9th July, 1958. (883177.)

23902. Siemens-Schuckertwerke A.G.—Hall generators. 24th July, 1958. (883096.)

24159. Lekens, E.—Transformers, choke coils and all similar devices, as well as stampings used therefor. 28th July, 1958. (883178).

25501. Western Electric Co., Inc.—Electromagnetic wave transmission systems. 8th August, 1958. (883179.)

30071. Soc. Financiere d'Expansion Commerciale et Industrielle S.A. Sfindex.—Electrostatic precipitators. 19th September, 1958. (882803.)

30650. United Kingdom Atomic Energy Authority.—Liquid-liquid contacting apparatus. 10th September, 1959. (882731.)

39281. Ferranti, Ltd.—Inductive windings. 3rd December, 1959. (882867.)

41156. Nippon Electric Co., Ltd.—Automatic control circuit for invertor incorporating hot cathode grid controlled discharge tubes. 19th December, 1958. (882804.)

1959

11012. Westinghouse Electric Corporation. —Electrical invertor systems. 1st April, 1959. (882126.)

14627. Lignes Telegraphiques & Telephoniques.—Electrical apparatus and circuit arrangements incorporating such apparatus. 29th April, 1959. (882127.)

16981. Dawe Instruments, Ltd.—Transistor circuits. 5th May, 1960. (882294.)

21798. Babcock & Wilcox, Ltd.—Nuclear reactors. 22nd June, 1960. (882670.)

22365. Westinghouse Brake & Signal Co., Ltd.—Dry metal rectifier assemblies. 3rd June, 1960. (882392.)

23486. Philips Electrical Industries, Ltd. —Manufacture of semiconductive bodies from a melt. 8th July, 1959. (882570.)

24173. General Electric Co., Ltd.—Envelopes for electrical devices. 4th July, 1960. (882190.)

27747. Electrotechnische Industrie Voorheen W. Smit & Co., N.V.—Circuit-breakers for large electric currents. 13th August, 1959. (882237.)

28209/10. Stone & Co. (Deptford), Ltd., J.—Pantograph current collectors. 15th August, 1960. (882315 and 882339.)

28311. Häny, M., Häny, T., and Hany-Pfister, E. (trading as Hany & Cie.).—Squirrel cage induction motors. 19th August, 1959. (882513.)

28490. Commissariat à l'Energie Atomique. —Safety devices. 20th August, 1959. (882402.)

29357. Collins Radio Co.—Doppler radar systems. 27th August, 1959. (882135.)

30262. United Kingdom Atomic Energy Authority.—Nuclear reactors. 2nd September, 1960. (882224.)

36593. Bassani S.p.A.—Electric snap-action switches. 28th October, 1959. (882661.)

36738. Bristol Co.—Electromagnetic switching device. 29th October, 1959. (882683.)

37249. Brookhirst Igranic, Ltd.—Electric motor control systems. 3rd November, 1959. (882625.)

1960

2568. Controls Co. of America.—Snap-action electrical switches and a process for making the switches. 25th January, 1960. (882850.)

6263. Standard Telephones & Cables, Ltd.—Processes in the manufacture and installation of electric cable. 23rd February, 1960. (883155.)

30120. Standard Telephones & Cables, Ltd.—Photo-responsive electric circuit arrangements. 1st September, 1960. (882168.)

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 13th January, 1962.

Ampower. No. B766,049. Class 7. Machines and machine tools for coding, stamping and crimping electrical terminals, for stripping insulation coverings from wire and for attaching steel bands and electrical terminals to wire and crimping heads, dies and die inserts. **Ampli-Cator.** No. 766,051. Class 7. Machines for use in the manufacture and installation of electrical apparatus and instruments; machine tools; and motors (not for land vehicles). **Ampli-Cator.** No. 766,052. Class 8. All goods included in Class 8. **Ampower.** No. 766,050. Class 9. Terminals, and devices included in Class 9 for use in making multiple connections in electrical wiring systems.—Amp, Inc., U.S.A. Address for service: Urquhart-Dykes & Lord, Maxwell House, Arundel Street, Strand, London, W.C.2.

Weathermaster. No. 818,720. Class 7. Electric washing machines, drying machines and combined washing and drying machines. —Bendix Home Appliances, Ltd., Albion Works, Kingsbury Road, Birmingham, 24.

Winsfield. No. 820,081. Class 9. Batteries, insulated cables, vacuum cleaners, flat-irons, soldering irons, switches, transformers.—F. W. Woolworth & Co., Ltd., Woolworth House, 242-246, Marylebone Road, London, N.W.1.

Wandleradio-Hitem. No. 818,754. Class 9. Electric cables for use in radio-communications.—Wandleside Cable Works, Ltd., 106, Garratt Lane, Wandsworth, London, S.W.18.

Badge design. No. 816,697. Class 9. Sound recording and sound reproducing apparatus and instruments; electrical apparatus and instruments included in Class 9; radio and television receiving sets, etc.—Magnavox Co., U.S.A. Address for service: McKenna & Co., 12, Whitehall, London, S.W.1.

Windak. No. 824,638. Class 9. Electrically heated clothing and foot muffs; articles of clothing for protection against accident or injury.—Baxter, Woodhouse & Taylor, Ltd., Woodside, Poynton, Cheshire.

Reliacons. No. 825,742. Class 9. Electrical condensers.—Erie Resistor, Ltd., Millora Works, Beevor Road, South Denes, Great Yarmouth, Norfolk.

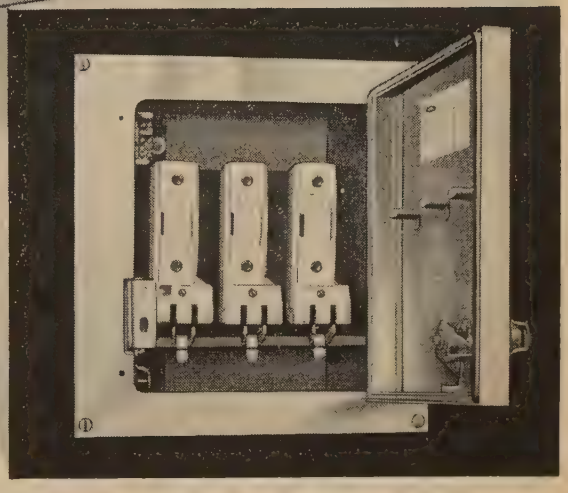
Badge design containing letters **EE.** No. B814,746. Class 11. Electric fans, heaters included in Class 11, and air-conditioning installations.—Emerson Electric Mfg. Co., U.S.A. Address for service: Stevens, Langner, Parry & Rollinson, 5-9, Quality Court, Chancery Lane, London, W.C.2.

Airglow. No. 815,579. Class 11. Installations for lighting and heating.—Artic Fuse & Electrical Manufacturing Co., Ltd., Elizabeth Avenue, Birtley, County Durham.

MEM

NEW CUBICLE SWITCHBOARDS & FLUSH MOUNTING CUBICLE UNITS

A range of Cubicle Units designed to facilitate the construction of Cubicle Panels in the Workshop or on site. This range of Switchgear is available in ratings from 15 to 800 Amps.



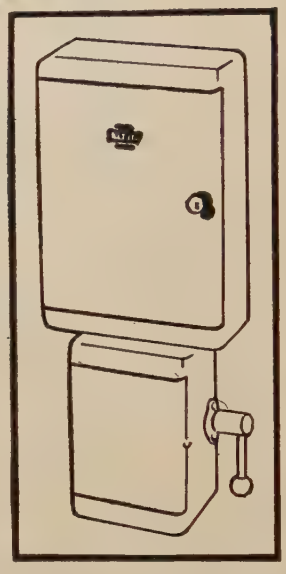
The "Exel", "Glasgow-Rex" and "Glasgow-Exel" ranges of Switchgear in ratings from 15 to 800 amps. is now available in the form of flush mounting Cubicle Units, with front operating switch handles.

The flush plates which carry the complete Switchgear Chassis are made in a limited number of standardised plate sizes, and each Cubicle Unit is ready drilled for direct mounting on the framework of cubicle switchboards, which can be built by electrical engineers to suit the requirements of any installations. Alternatively the M.E.M. Panels Department will be happy to quote customers for complete built up Cubicle Switchboards incorporating these units.

Write for List No. 450

MIDLAND ELECTRIC MANUFACTURING CO. LTD., REDDINGS LANE, TYSELEY, BIRMINGHAM, 11

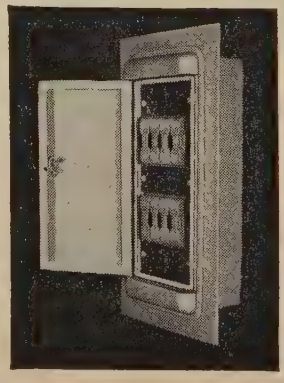
Key to cabinet quality



Compact lines, technical superiority, simple press-lock opening. These are all key points in the "Fluvent" range of cabinet style distribution boards, constructed of steel with a grey corrosion-proof hammer finish. Control switches of matching appearance can be mounted in conjunction with the boards, as illustrated. Even more unobtrusive are the recessed-mounted models—one shown below—designed to fit into a wall cavity.

AEROFLEX **Fluvent**

CABINET STYLE
DISTRIBUTION BOARDS



Aeroflex ENERGY LIMITING FUSES

Fluvent Cabinet Style Distribution Boards are fitted with Aeroflex Energy Limiting High Breaking Capacity Rewireable Cartridge Fuses to B.S. 88-1952 Cat 440 AC5 Class P. Standard fully wired cartridge fuse-links are used unless otherwise specified, when appropriate underwirings can be fitted.

* *Please write for List DBC 2 for full details of distribution boards.*

Parmiter Hope & Sugden Ltd

FLUVENT ELECTRICAL WORKS · LONGSIGHT · MANCHESTER 12
Telephone: Ardwick 1381 (4 *lines*)

London: 34 *Victoria Street, S.W.*1. *Telephone: Abbey* 2643
Glasgow: 5 *Somerset Place, C.*3. *Telephone: Douglas* 4975
Birmingham: 39/41 *Carrs Lane,* 4. *Telephone: Midland* 4115

You've more in hand with FLUVENT

PH196

Financial Section

STOCKS and SHARES

STOCK EXCHANGE markets are ending 1961 in a mood which contrasts soberly with the exuberant optimism prevailing at the start. In the opening five months industrial share prices were rocketed to the highest altitudes ever recorded. The descent to earth began when the weakening of the pound and a widening gap in overseas trade gave warning signals of excessive pressure on the economy, and it had turned into a steep dive by the time the Chancellor took the appropriate action in July. With Bank Rate up to 7 per cent, new restrictions on credit and consumption, an appeal for dividend restraint, and the introduction of the wages pause policy share prices lost the whole of the previous advance. Following the Bank Rate reduction to 6 per cent, prices became steadier in the autumn at a level 20 per cent below the peak, but were still subdued by a succession of company reports showing the effect of contracting profit margins upon current earnings. As a net result, the indices to leading share prices show little material change over the whole year, following their decline of some 10 per cent in the previous twelve months. In the electrical sections experiences were mixed, as is shown by the following tables of comparisons.

Electrical Engineering

Shares of the major electrical groups had another very disappointing year. They were affected throughout by the evidence of surplus capacity in some of the heavy branches, of difficulties in the field of domestic equipment, and of still precariously narrow profit margins generally. In the later months the market was further dispirited by warnings in interim statements from both A.E.I. and English Electric to the effect that final dividend rates might have to be cut next year. G.E.C. shares were helped by a more hopeful review in the annual report. Heavy engineering issues were relatively steadier, although Babcock & Wilcox were depressed by the passing of the interim dividend.

Company	Prices 1961		Change
	Jan.	Dec.	
A.E.I.	40/–	29/–	–11/–
Crompton P.	11/3	12/9	+ 1/6
English Elec.	35/–	23/–	–12/–
G.E.C.	29/6	24/–	– 5/6
C. A. Parsons... ...	47/–	50/9	+ 3/9
A. Reyrolle	39/6	43/9	+ 4/3
Babcock & W. ...	32/6	20/6	–12/–
Clarke Chapman ...	45/3	36/6	– 8/9
Head Wrightson ...	23/–	20/6	– 2/6
Int. Combustion ...	24/3	25/9	+ 1/6
Richardsons W. ...	6/9	3/9	– 3/–
Simon Engineering ...	29/9	30/9	+ 1/–

Domestic and Other Equipment

The behaviour of shares connected with domestic and motor car equipment, radio and television was in many cases much better than might have been expected in the light of the added restrictions affecting trade in these fields. Several shares concerned with refrigerators and washing machines suffered badly, but there were brilliant performances once again from Dimplex and Berry's Electric Magicoal. Hoover declined moderately. E.M.I. held their own, while the extent of the improvements in Decca, Thorn and Ever Ready looked remarkably good in the circumstances. In other sections, the appreciation of more than 70 per cent in Elliott-Automation and I.C.T. was extraordinary by any standards: the prospect of a change to decimal coinage was a factor.

Company	Prices 1961		Change
	Jan.	Dec.	
Berry's Electric ...	37/6(c)	66/–	+28/6
Brit. Electronic Ind. ...	14/6	10/6	– 4/–
Bulpitts	16/9	18/9	+ 2/–
Chloride Elec. ...	74/9	78/6	+ 3/9
Decca "A"	53/9	70/–	+16/3
Dimplex	28/9(c)	53/–	+24/3
E.M.I.	43/9	44/6	+ 9d
Elliott-Auto.	25/9	44/6	+18/9
Ever Ready	31/9	45/6	+13/9
Goblin...	6/3	4/6	– 1/9
Hoover	47/–	44/–	– 3/–
I.C.T.	61/3	108/–	+46/9
Lucas	63/–	62/6	– 6d
Radiation	31/9	23/3	– 8/6
S. Smith	16/9	16/3	– 6d
Thorn	45/9	67/–	+21/3

Equipment and Manufacturing

Plessey showed a useful net improvement during a year which included a scrip issue and the important telephone acquisitions. On the other hand Electric Construction depreciated sharply as a result of a cut in the dividend, and for the same reason Westinghouse Brake were exceptionally depressed. On the whole, however, changes in share prices in the general fields of electrical engineering corresponded fairly closely with the average for the industrial market.

Company	Prices 1961		Change
	Jan.	Dec.	
Bowthorpe	8/3	8/–	– 3d
Brook Motors ...	47/9	55/6	+ 7/9
Combined Elec. ...	8/–	7/–	– 1/–
Crabtree Elec. ...	28/–	25/3	– 2/9
Dewhurst	3/9(c)	5/9	+ 2/–
Elec. Construction ...	31/9	19/6	–12/3
Laurence, Scott ...	18/–	16/3	– 1/9
Plessey	36/9(c)	43/6	+ 6/9
Ward & Goldstone ...	27/–	27/6	+ 6d
West, Allen	11/3	10/–	– 1/3
Westinghouse ...	40/6	23/–	–17/6

Cables and Telephones

In the same way as earlier mergers within the cable manufacturing industry left a limited number of direct investments in that field, the past year's absorption of Automatic Telephone & Electric and Ericssons into the Plessey group has greatly narrowed the openings for investing in the telephone industry. In the cable group, B.I.C.C. shares responded well to evidence in the company's interim statement of an appreciable improvement in profit margins, although these are still too narrow to be comfortable. Aberdare Holdings finished the year at their top price, while Pyrotenax and Reliance-Clifton also acted well.

Company	Prices 1961		Change
	Jan.	Dec.	
Aberdare Holdings ...	10/9 (c)	12/6	+ 1/9
Aerialite	7/–	5/–	– 2/–
B.I.C.C.	49/6	56/–	+ 6/6
Dictograph	8/3	10/3	+ 2/–
Hackbridge	5/9	4/9	– 1/–
J. & P.	17/3	21/–	+ 3/9
Pyrotenax	35/6(c)	44/9	+ 9/3
Reliance-Clifton ...	15/–(c)	20/6	+ 5/6

(c) Prices adjusted for subsequent scrip issues.

British Electricity Stocks

The gilt-edged market emerges in rather better shape than might have been expected from a year which included at various times an increase in the pressure of inflation, the hoisting of Bank Rate to 7 per cent as a countermeasure, the subsequent reduction to 6 per cent, and finally the passing of the new Act empowering trustees to switch from gilt-edged holdings to equities. On balance, the "irredeemables" lost fairly heavily, War Loan for instance being some 7 points down, but stocks with fixed and not unduly distant repayment dates held their values well. Among the principal British Electricity issues, the 3 per cent stock redeemable 1968-73 and the 4½ per cent 1967-69 finished almost unchanged, and losses in the others amounted only to one or two points.

Yields on Industrials

In the early part of the year, dividend increases were still fairly numerous, so that in conjunction with a lower level of share prices, the result has been to raise quite appreciably the average yield available from a wide variety of industrials. Where dividend prospects are particularly obscure,

returns may be in the 8 to 10 per cent range, as for instance in the case of the major electrical groups. At the other end of the scale, investors are still prepared to accept returns of 2 to 3 per cent, or even less, if the growth characteristics are regarded as outstanding. In between, the electrical lists offer yields of 4 to 6 per cent on the shares of companies engaged in a considerable variety of electrical activities.

REPORTS and DIVIDENDS

Westinghouse Brake & Signal Co., Ltd.—Group trading profits for the year to 30th September last fell from £2,394,819 to £1,747,032 and, after heavier interest charges and reduced tax provision, the net profit is £782,979, compared with £1,119,893 in the previous year. The final dividend of 6½ per cent, making 9 per cent for the year, shows a reduction of 2 per cent, although in August, when the directors reported a lower current rate of profits, they said they expected to maintain the 11 per cent dividend unless the general course of trade deteriorated.

Ada (Halifax), Ltd., report a trading loss of approximately £50,000 in the half-year ended 30th September, 1961, during which time the sales volume of domestic appliances was slightly below that for the corresponding period last year. The loss included some items of a non-recurring nature and there are indications, following the implementation of plans outlined in the chairman's statement earlier in the year, that this rate of loss will decrease during the second half of the year.

W. H. Allen, Sons & Co., Ltd.—In announcing an interim dividend of 2½ per cent (the same), the directors state that the profit for 1961 will be lower than that anticipated in July at the annual meeting. Although the order book position has improved, the decline in profit margins has been accentuated.

Muirhead & Co., Ltd. — Pre-tax profits increased from £352,509 to £440,623 during the year to 30th September last, and after tax of £220,355 (£173,401) the net balance is £220,268 (£179,108). A final dividend of 7½ per cent again makes a total of 10 per cent for the year.

Murex, Ltd.—Group sales fell by 3 per cent in the six months ended 31st October compared with the corresponding period of 1960 and group net profits were 10 per cent lower, reflecting reduced operating margins and higher profits tax.

Profits were in line with those of the six months ended 30th April, 1961. The modest decline in demand has continued to date and present indications are that the group trading results for the year will not reach those of the two preceding years. The interim dividend is repeated at 5 per cent for the year ending 30th April, 1962.

Group trading operations during the first six months fell slightly below the exceptional level of activity experienced in the period May-October, 1960. A declining demand for ferro alloys and metals for the steel industry was partially offset by increased sales of special alloys, powder metallurgy products and welding electrodes, it is stated.

Capital expenditure during the half-year, mainly at the Rainham works, amounted to £180,000 compared with £237,000 in the corresponding period of 1960, which included part of the expenditure on the new plant shop and offices at Waltham Cross. Outstanding capital projects authorised at 31st October amounted to £390,000, although some part of this expenditure will not fall due for payment in the current financial year.

Burco Dean, Ltd., have announced a final dividend of 6 per cent, making 9⅓ per cent for the year to 30th September, 1961, compared with the previous year's total of 15 per cent. Group profits decreased from £110,673 to £80,910, after charging U.K. tax of £95,707 (£100,799).

Gas Purification & Chemical Co., Ltd. — The chairman, Mr. D. D. Mathieson, said at a recent meeting in London that profits for the first four months of the current year ending 30th June next should be approximately £35,000. Although the first three months had shown a small overall group loss, October had been a very good month. Shareholders criticised the serious difference between the board's estimated profits of £230,000 for the half-year to 30th June last and the loss disclosed of nearly £15,000. The slide in profits, said Mr. Mathieson, could be attributed to Grundig (Great Britain) and A.B. Metal Products. The £300,000 for the sale of the machine tool division of Smart & Brown should be received in January, he said, and approximately £30,000 would be saved on overheads by the transfer of the electrical side to A.B. Metal Products.

New Companies

McLachlan & Howley, Ltd.—Registered 6th December. Capital £6,000. To acquire the business of electrical engineers and contractors carried on by Nora A. L. McLachlan and Philip G. Howley at Albrighton, nr. Wolverhampton, as McLachlan & Howley, etc. Directors: Nora A. L. McLachlan (secretary) and P. G. Howley. Regd. office: 16, High Street, Albrighton, nr. Wolverhampton.

Electroright, Ltd.—Registered 1st December. Capital £100. Manufacturers of and dealers in artificial lighting apparatus, electrical plant, etc. Directors: H. Wale, R. A. Wale, G. R. W. Wright and H. J. Hodge. Regd. office: 7, All Saints Passage, Cambridge.

F.N. Maintenance Services, Ltd.—Registered 1st December. Capital £100. Specialists, designers, patentees, workers, manufacturers of and dealers in electronic, mechanical, electrical equipment, etc. Directors: F. G. Fowler and H. J. Naden (secretary). Regd. office: 100/102, High Street North, East Ham, E.6.

Meeting of Creditors

Regal Electrics, Ltd.—Meeting of creditors at 53, High Street, Fareham, on 3rd January pursuant to Section 293 of the Companies Act, 1948.

Liquidations

Winding-up proceedings or liquidations are often undertaken for the purpose of reconstruction, the transfer of a business, or other reasons. The appearance of a company's name under this heading therefore does not necessarily indicate insolvency.

Bestfrend Electrical Co., Ltd., domestic electrical appliance manufacturers, Craig's Court House, 25, Whitehall, London, S.W.1. —Winding up voluntarily. Liquidator, Mr. R. H. Macintyre, Craig's Court House, 25, Whitehall, London, S.W.1, appointed by members and creditors on 12th December. Particulars of claims to the liquidator by 15th January.

Arolby Engineering Co., Ltd., heating, ventilating and electrical engineers, Headley Road, Grayshott, Hindhead.—Liquidator, Mr. H. J. R. Roffe, 74, High Street, Godalming, Surrey, appointed by creditors 6th December.

L. & I. Clarke Electrical Co. (Portslade), Ltd.—Particulars of claims to the liquidator, Mr. J. S. Bradley-Hole, 7, Old Steine, Brighton, by 5th January.

Ramsden Bros. (Blackpool), Ltd., builders and electrical engineers, 14, Abingdon Street, Blackpool, Lancashire.—Liquidator, Mr. R. Lockwood, 14, Abingdon Street, Blackpool, Lancs., appointed 10th November.

Don Kenyon Electrical (Nottingham), Ltd. —Meetings of members and creditors at 42, Friar Gate, Derby, on 29th January to receive an account of the winding up from the liquidator, Mr. R. C. Ravensdale.

Bankruptcies

J. A. Spence, lately carrying on business at 15, Binchester Street, South Shields, Durham, general dealer.—Last day for receiving proofs for dividend 4th January. Trustee, Mr. W. Armstrong, Clarendon House, Clayton Street West, Newcastle-upon-Tyne, 1.

R. Powell, lately carrying on business as an electrical goods retailer under the style of Domestic Electrics at 127, Newgate Lane, Mansfield, Nottingham.—Supplemental dividend of 1s 4½d in the £ payable at the Official Receiver's Office, 37, Holy Green, The Moor, Sheffield.

W. Bell, lately carrying on business at 61, Headlam Street, Byker, Newcastle-upon-Tyne, under the style of Heaton Electronics as a radio and television dealer and electrical contractor.—First and final dividend of 8d in the £ payable 9th January at Clarendon House, Clayton Street West, Newcastle-upon-Tyne.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Argentina.—Province of Santa Fé, Ministry of Works. 22nd January. Power station and high voltage systems. (E.S.B. 38283/61.)*

Australia.—Electricity Commission of New South Wales. 5th February. Power circuit-breakers. (E.S.B. 38250/61.)* 22nd January. Transformers. (E.S.B. 38281/61.)*

State Electricity Commission of Queensland. 28th March. 30 MW turbo-generators. (E.S.B. 38573/61.)*

Bournemouth.—Borough Council. 5th January. Electrical installation and underfloor electric heating in sewage disposal works at Holdenhurst. Farmer & Dark, 14, High Street, Poole.

Brighton.—Borough Council. 26th January. Two electrically driven submersible borehole pumps, with control gear, etc., for Sompting pumping station. Chief engineer, 12, Bond Street, Brighton, 1.

Burma.—Electricity Supply Board, Rangoon. 24th January. Electrical equipment and material. (E.S.B. 38517/61.)*

Ceylon.—Ministry of Agriculture, Land, Irrigation and Power, Colombo. 6th February. Circuit-breakers. (E.S.B. 37952/61.)*

Dagenham. — Borough Council. 31st January. Electrical installation and hot water and allied services installation for Marks Gate County Junior School. (See Classified Advertisement Section.)

Ealing.—Borough Council. 1st February. Renewal of electrical installations in 255 council dwellings at South Hanwell. (See Classified Advertisement Section.)

Ethiopia.—Imperial Board of Telecommunications, Addis Ababa. 15th January. Armoured cable. (E.S.B. 38289/61.)*

Friern Barnet.—U.D.C. 19th January. Supply of street lighting lamps. (See Classified Advertisement Section.)

India.—Supply Mission, Washington, U.S.A. 2nd February. Transformers, arrestors and surge counters. (See Classified Advertisement Section.)

Chief Engineer (Electrical), Bombay. 19th February. Hydro-electric plant. (E.S.B. 38537/61.)*

Madras State Electricity Board. 1st March. Power station plant. (E.S.B. 38538/61.)*

London.—Westminster City Council. 15th January. Supply of electric lamps. Town clerk, Westminster City Hall, P.O. Box 141, London, W.C.2.

Manchester.—City Council. 8th January. Electrical installation in proposed workshops at St. Joseph's Police Buildings, Longsight. City architect, P.O. Box 488, Town Hall.

Nicaragua.—La Empresa Nacional de Luz y Fuerza. 1st March. Hydro-electric system. (E.S.B. 38600/61.)*

Northern Ireland. — Belfast Electricity Department. 19th January. Switchgear, time switches, transformers, etc. (See Classified Advertisement Section.)

5th January. Street lighting installation at Downpatrick. Clerk to the R.D.C., Quoile Road, Downpatrick, Co. Down.

15th January. Electrical installation in proposed old people's home at Wilmont House, Dunmurry. Abbott & Partners, 16, May Street, Belfast, 1. Electrical installation in Moyarget New Primary School. Kenneth A. MacCormac, director of education, 475, Antrim Road, Belfast, 15.

Pakistan.—Water and Power Development Authority, Lahore. 24th January. Shackle insulators. (E.S.B. 38846/61.)*

Peterlee (Co. Durham).—Development Corporation. 8th January. Supply and erection of eight street lamps at Surtees Road, 13 at Chapel Hill, and 41 at Passfield Way, Peterlee. A. V. Williams, general manager, Shotton Hall, Old Shotton, Peterlee.

Rhodesia and Nyasaland. — Electricity Department, Bulawayo. 17th January. Cable, cable boxes, cable compound and conductor. (E.S.B. 38570/61.)*

Romford.—Borough Council. 15th January. Electrical installation for old people's flatlets. (See Classified Advertisement Section.)

Thurrock.—U.D.C. 29th January. Mobile generator. (See Classified Advertisement Section.)

Wanstead and Woodford.—Borough Council. 15th January. Installation of 41 group "A" and 344 group "B" lighting units. (See Classified Advertisement Section.)

Wrexham.—Borough Council. 15th January. Switch and fuse chambers and miniature circuit-breaker chambers. (See Classified Advertisement Section.)

ORDERS PLACED

Durham.—County Education Committee. Electrical work in schools: Frosterley South County School (£1,221) and Wearhead County School (£1,088).—J. Paterson (Darlington). Seaham Grammar Technical School (£16,964).—John Calvert.

Hereford.—Housing Committee. Wiring 146 houses on the Newton Farm estate (£3,580).—H. A. Nunn & Son.

Longbenton (Northumberland).—U.D.C. Recommended. Supply and erection of 144 Class "B" lighting units.—Eleco.

Sheffield. — Regional Hospital Board. Improvement of drive lighting at the Kingsway Hospital, Derby (£1,726).—William Camm & Co.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Arbroath.—Houses (51), Timbergreens site; Scottish Special Housing Association, Ltd., 15, Palmerston Place, Edinburgh.

Ashington.—Maternity unit and nurses' home at Ashington General Hospital; P. H. Knighton, chief architect, Newcastle Hospital Board, Benfield Road, Newcastle-on-Tyne.

Aylesbury.—Block of factories at Stocklake industrial site; resident architect, 16, Walton Street, Aylesbury.

Bedford.—Works extensions (£1,500,000); W. H. A. Robertson & Co., Ltd., Ampthill Road.

Billingshurst. — Old people's home (£89,100) for West Sussex C.C.; county architect, County Hall, Chichester.

Bilston.—Houses (61); A. M. Williams, town clerk, 20, Wellington Road, Bilston, Staffs.

Brentford.—Works extensions; Beecham Group, Ltd., Great West Road.

Bristol.—Extensions, Almondsbury C.E. School; Burrough & Hannam, architects, 23, Richmond Hill, Clifton.

Brownhills.—Houses (44), Clayhanger; C. H. Hunt, U.D.C. surveyor, Coombe House, Brownhills, Staffs.

Burnham-on-Sea.—Flats and maisonnettes (130), Highbridge site; surveyor, Manor House, Manor Gardens, Burnham, Somerset.

Cambridge.—College buildings for Fitzwilliam House, The Grove; Denys Lasdun & Partners, architects, 3, Albany Terrace, London, N.W.1.

Cardiff.—Extension to Brynydon Approved School (£50,000); W. Clarke (Llandaff), Ltd., 98, Cardiff Road, Llandaff.

Christchurch.—Laundry at Christchurch Hospital for Wessex Regional Hospital Board; I. Todd, quantity surveyor, Beacon House, Christchurch Road, Bournemouth.

Corby.—Factory for Aquascutum, Ltd.; O. P. Drever & Son, Ltd., Roundhill Road, Kettering.

Crowborough.—Centre for arthritics; James A. Crabtree & Associates, architects, 70, Blandford Street, London, W.1.

Darlington.—Buildings on the site of the Gaumont Cinema; Goddard & Smith, architects, 22, King Street, St. James's, London, S.W.1.

Eccles.—Houses, Peel Green (58), and Crossfield Farm (44); town clerk, Town Hall Annexe, Irwell Place.

Edinburgh.—Rebuilding general offices and stores, King's Stables Road (£100,000), for lighting and cleansing department; A. Steele, city architect, City Chambers, High Street.

Falkirk.—Shops and offices, High Street and Cockburn Street (£97,500); Scottish Metropolitan Property Co., Ltd., 8, Gordon Street, Glasgow.

Gateshead.—Rebuilding part of factory, Team Valley trading estate, for Reed Millican & Co., Ltd.; Arthur & Kirkup, architects, 13, Swinburne Street, Gateshead.

Halesowen.—Dwellings (235), Highfields estate; borough engineer.

Hebburn (Co. Durham).—Proposed swimming baths; U.D.C. surveyor.

High Wycombe. — Works extensions; E. M. F. Brown, Ltd., Duke Street.

Holmes Chapel.—Phase II of scheme for major developments at Cranage Hall Hospital (£969,456); Manchester Regional Hospital Board, Cheetwood Road, Manchester, 8.

Ipswich.—Stage IV of the civic college; Johns, Slater & Haward, architects, 32, Foundation Street, Ipswich.

Isleworth.—Garage, workshops, showrooms and seven-storey offices; B. N. White-Spunner, Ltd., 632/52, London Road.

Lanarkshire.—New county buildings at Hamilton; D. G. Bannerman, county architect, 34, Albert Street, Motherwell.

Leicester.—Office block, Lee Street; Andrews, Emmerson & Sherlock, architects, 63, Dean Street, London, W.1.

London.—Flats and maisonnettes (169), Fleet Road area, Hampstead; Charles E. Jacob, architect, Haverstock Hill, N.W.3.

Six-storey shop and offices, Finchley Road, Hampstead; Harry Neal, Ltd., 117, Baker Street, W.1.

Factory, Linford Street, Nine Elms; Casein Industries, Ltd., Culvert Works, Sheepcote Lane, S.W.11.

Showrooms and offices (£185,000), Edgware Road, St. Marylebone; Gilbert Ash, Ltd., 45, Notting Hill Gate, W.11.

Middlesbrough.—Factory extension; Sach & Co., Ltd., Windermere Road.

Rebuilding shop premises, Linthorpe Road, for London and Northern Properties, Ltd.; Marshall & Tweedy, architects, 36, Blackett Street, Newcastle-on-Tyne.

Extensions to printing works, Longlands

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* This information is extracted from the Board of Trade *Export Service Bulletin*. Inquiries should be addressed to the Board of Trade, Export Services Branch, Lacon House, Theobald's Road, London, W.C.2 (Telephone: Chancery 4411, Ext. 738), quoting the reference given.

Road, for Jordison & Co., Ltd.; J. G. L. Poulson, architect, 54, Albert Road, Middlesbrough.

Newcastle-on-Tyne. — Proposed primary school at Cruddas Park and block of flats at Shieldfield; G. Kenyon, city architect, 18, Cloth Market, Newcastle.

Oxford.—Thirty-bed ward to Nuffield Orthopædic Centre; Stevens, Flavel & Beard, architects, 21, Turl Street.

Poole.—Eleven-storey block of flats, Langland Street; borough architect.

Portsmouth. — Workshops and offices; Vosper, Ltd., Hamilton Road, Paulsgrove.

Queenborough.—Houses (50); borough engineer, High Street, Queenborough, Sheerness.

Scarborough.—Houses (100), Sandybed; V. Forshaw, borough engineer.

Methodist home for the aged, North Lees Avenue; Evan E. Morgan, architect, 15, Park Row, Leeds.

Slough.—Shopping centre, High Street; H. Owen Luder, architect, 79, Regency Street, London, S.W.1.

Sunderland.—Four five-storey blocks of flats, each with 26 housing units, Bainbridge Holme estate; Stephenson, Gillis & Partners, architects, Saville Chambers, North Street, Newcastle-on-Tyne.

Factory for Megator Pumps & Compressors, Ltd., 43, Berkeley Square, London, W.1.

Surrey.—Fire stations at Camberley (£61,000) and Richmond (£61,900); county architect, County Hall, Kingston-on-Thames.

Swansea.—Mining and engineering block to College of Technology; borough architect.

Wallingford.—Occupational therapy unit and central stores, Fair Mile Hospital; Morton Lupton, architect, 1, Church Street.

Walthamstow.—Branch library, Hale End; borough architect.

Woburn.—Housing estate, Apsley Guise; Prowting Estates, Ltd., 127, High Street, Ruislip.

Wombwell.—Houses (72), Wentworth Road site, and flats (20), Elliott Avenue site; C. Knowles, surveyor, Town Hall, Wombwell, near Barnsley.

Yorkshire.—County primary school (280 pupils), Bricknell Avenue, Cottingham; G. L. Thompson, architect, 46a, Coney Street, York.

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 243a, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged, but, in some cases, not yet announced

MONDAY, 1st JANUARY

Cardiff.—South Wales Institute of Engineers, Park Place, 7.30 p.m. A.S.E.E. South Wales Branch. Film evening.

TUESDAY, 2nd JANUARY

Birmingham.—Town Hall, 7 p.m. I.E.E. South Midland Centre. Faraday Lecture. "Expanding Horizons in Communications," by D. A. Barron.

James Watt Memorial Institute, Great Charles Street, 6.30 p.m. Institute of Metal Finishing, Midland Branch. Discussion on "Stripping and Reclamation of Defective Plated Work," to be opened by T. E. Such.

Bristol.—R.W.A. School of Architecture, 6.30 p.m. Institution of Heating and Ventilating Engineers, South Western Branch. "The Application of Pneumatic Controls to Air Conditioning with Special Reference to High Velocity Air Conditioning," by G. F. Brown.

Leeds.—Leeds and County Conservative Club, South Parade, 6.30 p.m. I.E.E. North Midland Centre. "Progress in Oil-Filled Cables and their Accessories," by Dr. A. N. Arman, Dr. F. J. Miranda and G. R. Bishop.

London.—Lecture Theatre, Savoy Place, 3 p.m. Institution of Electrical Engineers. Children's Christmas lecture on "Lightning," by Prof. J. M. Meek. (To be repeated at 10.30 a.m. and 3p.m. on Wednesday, 3rd January.)

White Hart, 49, King's Road, Chelsea, S.W.3, 7.45 p.m. A.S.E.E. West London Branch. "Hospital Electrical Installations," by R. H. Betteley.

Eltham Green School, Queenscroft Road, Eltham, S.E.9, 7.45 p.m. A.S.E.E. South East London Branch. Film show.

Reading.—Caversham Social Club, Caversham, 7.30 p.m. A.S.E.E. Reading and Districts Branch. "Photo-electric Cells."

WEDNESDAY, 3rd JANUARY

Leicester.—Grand Hotel, 7.30 p.m. Institution of Plant Engineers, Leicester Branch. "Safety of an Electrical Installation," by F. Noakes.

London.—School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1, 10 a.m. British Institution of Radio Engineers. All-day symposium on "Data Transmission."

1, Birdcage Walk, Westminster, S.W.1, 6 p.m. Institution of Mechanical Engineers, Lubrication and Wear Group. Discussion on "Wear of Rubbing Electrical Contacts."

Manchester.—N.W.E.B. Service Centre Theatre, Town Hall Extension, St. Peter's Square, 7.30 p.m. A.S.E.E. Manchester Branch. Lecturettes.

Middlesbrough.—Cleveland Scientific and Technical Institution, 6.30 p.m. I.E.E. Tees-Side Sub-Centre. "The Application of Electrical Technology to Instruments in the Chemical Industry," by J. C. Quayle.

Morden.—Crown Hotel. A.S.E.E. South West London Branch. New Year's Party.

Preston.—Farmer's Arms Hotel, Market Street, 7.30 p.m. A.S.E.E. Preston Branch. "The Rayon Industry and its Electrification," by C. R. Seed.

Southampton.—Polygon Hotel, 7.30 p.m. Institution of Plant Engineers, Southern Branch. Forum on "Engineering Education and Training."

University, 7 p.m. I.E.E. Southern Centre. "Short-Circuit Ratings for Main Cables," by G. S. Buckingham, and "A Basis for Short-Circuit Ratings for Paper Insulated Cables up to 11 kV," by L. Gosland and R. G. Parr.

Swansea.—Demonstration Theatre, South Wales Electricity Board, Kingsway, 6 p.m. I.E.S. Swansea Group. "Floodlighting for Industrial Situations," by A. E. Fothergill.

Wolverhampton. — Wolverhampton and Staffs. College of Technology, 7.15 p.m. Institution of Production Engineers, Midlands Region. "Recent Developments in Automatic and Semi-Automatic Welding," by L. H. Morgan.

Wood Green.—Civic Centre, N.22, 8 p.m. A.S.E.E. North London Branch. "The Railways and Industry," by D. L. Barlow.

THURSDAY, 4th JANUARY

Brighton.—Cricketers Hotel, Black Lion Street, 7.30 p.m. A.S.E.E. Brighton, Hove and Districts Branch. "New Requirements for Lighting Commercial Buildings," by J. E. Roper.

Cardiff.—Grand Hotel. I.E.S. Cardiff Centre. Joint film evening with the Electrical Association for Women.

Coventry.—Hotel Leofric, 7.30 p.m. Institution of Plant Engineers, Birmingham Branch. Open Forum.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Fourth Hunter Memorial Lecture. "The Transmission of Power at High Voltages," by F. J. Lane.

54, Prince's Gate, Exhibition Road, South Kensington, S.W.7, 11 a.m. Institute of Welding. Young people's Christmas lecture on "Joining the Modern Way."

Nottingham.—Electricity Centre, Carrington Street, 6 p.m. I.E.S. Nottingham Centre. "Lighting for Crime Detection," by C. H. Edlin.

Stoke-upon-Trent.—Hanley Town Hall, 7 p.m. I.E.E. North Staffordshire Sub-Centre. Faraday Lecture. "Expanding Horizons in Communications," by D. A. Barron.

FRIDAY, 5th JANUARY

Farnborough.—Salesian College Hall, Peabody Road. A.S.E.E. Aldershot and Districts Branch. New Year's Ball.

Liverpool. — Industrial Development Centre, M.A.N.W.E.B., Paradise Street, 7.30 p.m. A.S.E.E. Liverpool and District Branch. "Causes, Effects and Calculation of Faults in Electrical Systems."

London.—Savoy Place, W.C.2, 6 p.m. I.E.E. Medical Electronics Discussion Group. Discussion on "Membranes," to be opened by Dr. H. Davson.

I.E.E. Lecture Theatre, Savoy Place, W.C.2, 2.30 p.m. Plastics Institute. Young people's lecture on "Nature's Plastics," by Prof. M. Stacey.

SATURDAY, 6th JANUARY

Ecclesfield.—Gatty Memorial Hall. A.S.E.E. Sheffield Branch. Children's Christmas Party.

London.—Tavistock Banqueting Rooms, 18, Charing Cross Road, W.C.2, 7.30 p.m. I.E.E. London Graduate and Student Section. Twelfth Night dinner-dance.

Manchester.—College of Science and Technology, 3 p.m. I.E.E. North Western Centre. Children's lecture on "Lightning," by Prof. J. M. Meek.

AIRMEC EXHIBITION

The annual exhibition of Airmec, Ltd., will be held in Denison House, Vauxhall Bridge Road, London, S.W.1, from 15th to 19th January. Admission is by ticket only, obtainable free of charge upon request to the company at High Wycombe, Bucks. Their range of electronic instruments which will be on display includes ionisation testers, radiation monitors, frequency standards, signal generators, measuring instruments, power supply units and oscilloscopes.

Charge Engineers' Society

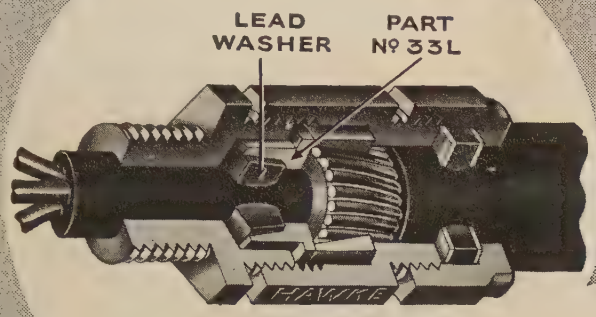
The London Division Charge Engineer Society has now changed its name to Charge Engineers' Society—South Eastern Region. This society was founded in 1954 for the promotion of educational and social activities amongst its members engaged in power generation. The president is Mr. H. J. Bennett (regional director, C.E.G.B.).

HAWKE introduce . . .

a new Gland

for

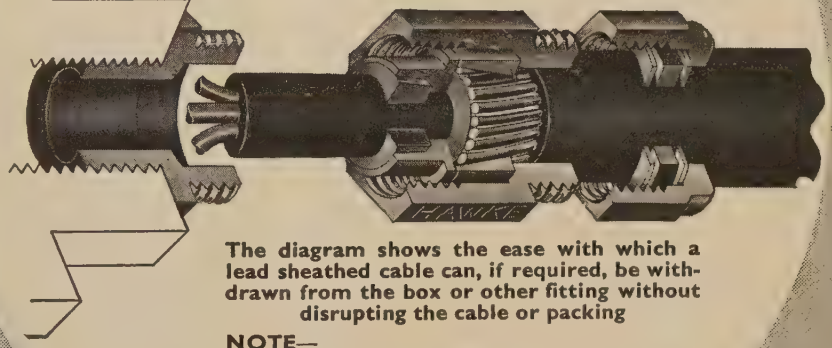
FLAMEPROOF & STANDARD INSTALLATIONS



The parts shown replace normal parts Nos. 22 and 33 for lead sheathed cables

An alternative method of gripping inner sheath on lead, P.V.C. and all other types of sheathed cables

This alternative method can be applied on the following glands: G62, G63, G64, G65, G67 and G68.
If it is required, customers should refer when ordering, to the normal gland size required and state the type of cable to be used.



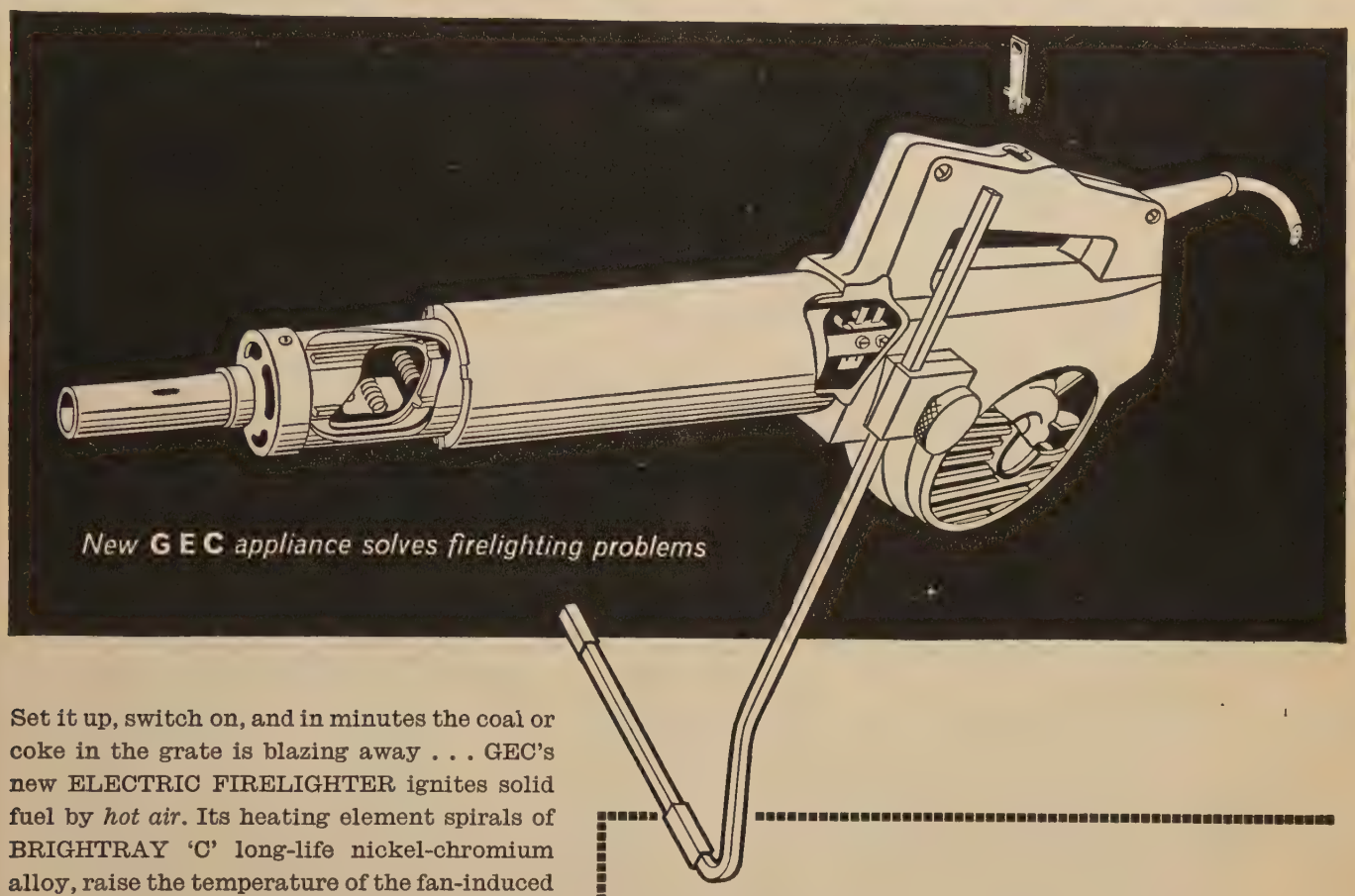
The diagram shows the ease with which a lead sheathed cable can, if required, be withdrawn from the box or other fitting without disrupting the cable or packing

NOTE—
CABLE OR WASHERS NOT DAMAGED IN ANY WAY

HAWKE CABLE GLANDS LTD.

Ashworth Street, Denton
Manchester *Phone: Denton 3868/9 & 3860*

FIRELIGHTING IS FASTER WITH HEATING ELEMENT SPIRALS OF Brightray*C ALLOY



Set it up, switch on, and in minutes the coal or coke in the grate is blazing away . . . GEC's new ELECTRIC FIRELIGHTER ignites solid fuel by *hot air*. Its heating element spirals of BRIGHTRAY 'C' long-life nickel-chromium alloy, raise the temperature of the fan-induced air to the point at which domestic solid fuels rapidly ignite. The 1800-watt BRIGHTRAY 'C' element can be switched off leaving the air jet to fan the flames. Running costs are low, firelighting easier, *and faster*.

Designers are invited to send for our publication giving useful data on the BRIGHTRAY Series of Electrical Resistance Materials.

*TRADE MARK

To Henry Wiggin & Company Ltd., Holmer Road, Hereford

Please send me a free copy of your publication 'Wiggin Electrical Resistance Materials'

NAME _____

POSITION OR DEPARTMENT _____

COMPANY AND ADDRESS _____

_____

_____ ER/E16/12

HENRY WIGGIN & COMPANY LTD · HOLMER ROAD · HEREFORD

TGA E 16

Classified Advertisements

CLASSIFIED advertisements are PREPAID at 4/- per line (approx. 6 words).
DISPLAYED CLASSIFIED:—53/- per single column inch.
Where an advertisement includes a Box Number there is an additional charge of 1/-.
SERIES DISCOUNTS for consecutive insertions:—13, 5%; 26, 10%; 52, 15%.
SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.
Remittances payable to "ELECTRICAL REVIEW."
REPLIES TO BOX NUMBERS should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1. If an applicant for a situation appearing under a Box Number does not wish his reply to be forwarded to a particular firm or individual, instructions to this effect should be addressed to the Advertisement Supervisor, ELECTRICAL REVIEW. The name of an advertiser using a Box Number cannot be disclosed.
Original testimonials should not be sent with applications for employment

Advertisements are accepted up to **first post on Monday** of the week of issue

If blocks, bold type or ruled borders are required then on **Friday** prior to week of issue

All communications to be addressed to:

Classified Advertisement Department,
ELECTRICAL REVIEW
Dorset House, Stamford Street
London, S.E.1

OFFICIAL NOTICES, TENDERS, ETC.

AIR MINISTRY

EXHIBITION

Showing World-wide activities of the Directorate General of Works for the Royal Air Force and Ministry of Aviation.

Civil Engineering, Mechanical and Electrical Engineering, Architecture, Quantity Surveying, Heating and Ventilating, Estates and Land Management.

Plant, Models, Photographs and Drawings.

Tuesday, 9th January to Saturday, 13th January, 10.30 a.m. to 6.30 p.m., at AIR MINISTRY, WHITEHALL, LONDON, S.W.1.

Admission free.

275

FRIERN BARNET URBAN DISTRICT COUNCIL

Annual Tenders

TENDERS are invited for the supply and delivery of Street Lighting Lamps for twelve months commencing 1st April, 1962.

Specification and form of tender, etc., may be obtained from the Engineer and Surveyor, Town Hall, London, N.11.

Tenders are to be delivered to the undersigned not later than 10 a.m. on Friday, 19th January, 1962.

R. S. CLOTHIER,
Clerk of the Council.

3286

BOROUGH OF EALING

Renewal of Electrical Installations of 255 Council Dwellings at South Hanwell

TENDERS are invited from approved N.I.C.E.C. contractors for the above-mentioned work. Specification and tenders from the Borough Engineer, Town Hall, Ealing, London, W.5, on receipt of deposit of £1, returnable on receipt of a bona fide tender.

Closing date 1st February, 1962.

E. J. COPE BROWN,
Town Clerk.

3285

INDIA SUPPLY DEPARTMENT

THE Officer of the India Supply Mission, 2536, Massachusetts Avenue, N.W., Washington, 8, D.C., United States of America, invites tenders for the following:—

TENDER ENQUIRY No. S/71/DLF.

For the supply of:—

(1) 18 single-phase two-limbed core type, 50 cycles, outdoor Potential Transformers, with fittings, accessories and spares.

(2) 42 heavy duty, station type valve action Lightning Arresters to be installed in outdoor switchyard, with fittings and hardware.

(3) 42 Surge Counters to be used with the lightning arresters.

For Chandrapura Thermal Power Station, required by Damodar Valley Corporation Ltd.

Specification, etc., relative to the above enquiry can be obtained from the Co-ordination Branch, India Store Department, Government Building, Bromyard Avenue, Acton, London, W.3, at a cost of 7 shillings and 2 pence per tender. THE COST OF THE TENDER DOCUMENT IS NOT REFUNDABLE, AND THE FORMS ARE NOT TRANSFERABLE. Tenders are to be returned direct to India Supply Mission, at the above address, and NOT TO THIS OFFICE, so as to reach them by 2nd February, 1962.

Only the manufacturers (including their constituents or associates authorised to commit them) or their accredited agents who are in a position to supply the requirements from their own or their principal's manufactures are invited to quote.

Specimen copy of the above enquiry can be seen at India Store Department, Engineering Branch, Bromyard Avenue, Acton, London, W.3, under reference No. S.3556/61/NSC/ENG.2.

3284

BOROUGH OF WREXHAM

120 Dwellings

TENDERS are invited for the following:—

(a) Supply of 120 Consumers' Combined Switch and Fuse Chambers and Cabinets, or

(b) Supply of 120 Consumers' Combined Switch and Miniature Circuit Breaker Chamber and Cabinets.

Applications for tender form and specification, for either of the above, should be made to the Borough Engineer and Surveyor, Guildhall, Wrexham, where copies of the house plans may also be inspected.

Completed tenders must be returned in the envelope provided, to the undersigned, by not later than 12 noon, Monday, 15th January, 1962.

The Council does not bind itself to accept the lowest or any tender.

PHILIP J. WALTERS,
Town Clerk.

Guildhall, Wrexham.
14th December, 1961. 3323

THURROCK URBAN DISTRICT COUNCIL

Engineer and Surveyor's Department

Mobile Generator

TENDERS are invited for the supply of a Trailer-mounted Mobile Generator having a rated output of not less than 144 kW at 415/240 volts, 50 cycles.

Copies of the specification and form of tender may be obtained from the Engineer and Surveyor, Council Offices, Whitehall Lane, Grays, on payment of £2 2s. deposit, which will be refunded on receipt of a bona fide tender.

The general conditions of contract may be inspected at the Engineer and Surveyor's office during normal office hours.

Tenders, accompanied by the specification, in the envelope provided, must reach the Clerk of the Council, Council Offices, Whitehall Lane, Grays, by not later than 12 noon on Monday, 29th January, 1962.

The Council do not bind themselves to accept the lowest or any tender.

A. E. POOLE,
Clerk of the Council.

Council Offices,
Whitehall Lane,
Grays, Essex.

3315

BOROUGH OF ROMFORD

Electrical Installations for Old People's Flatlets, Main Road, Romford

TENDERS are invited for the electrical installations of 22 Old People's Flatlets, with ancillary rooms, fire alarm and indicator systems, the work comprising conversion and extension of existing premises at No. 61, Main Road, Romford.

Specification, drawings and form of tender may be obtained from the Borough Engineer and Surveyor, Town Hall, Romford, on receipt of a deposit of £2 2s., returnable on receipt by the Town Clerk of a bona fide tender and/or return of the tender documents by Monday, 15th January, 1962.

3314

SKIPTON URBAN DISTRICT COUNCIL

Rewiring of Electrical Installations

TENDERS invited for rewiring 149 pre-war Council houses, Burnside Estate.

Contract documents from Engineer and Surveyor, Town Hall, Skipton, on deposit of £2 2s. (refunded on receipt of bona fide tender).

Tenders, in envelope provided, bearing no indication of sender, to be in by 8th January, 1962.

The Council do not bind themselves to accept the lowest or any tender.

L. E. SMITH,
Clerk of the Council.

3280

Official Notices (continued)

CITY OF BELFAST ELECTRICITY DEPARTMENT

Annual Stores

TENDERS are invited for the supply of the undermentioned materials during 12 months commencing 1st May, 1962:—

Form No.

1. Turbine Oil.
2. Insulating Oil for Transformers and Switchgear.
3. Firebricks, Fireclay, Binding Cement for High Temperature Furnace Requirements.
5. Carbon Brushes.
6. Steel Wire Ropes for Coal Handling Plant.
8. Glazed Stoneware Troughing, Pitch Fibre Conduits and Covering Tiles.
9. A.C. Distribution and Street Lighting Control Pillars.
10. 6.6-kV Indoor Metalclad Switchgear.
13. Time Switches.
14. L.T. Fuse Units, Service Cut-outs and Accessories.
15. Distribution Transformers.
16. Vulcanised Bitumen and Paper Insulated Cables, Joint Boxes, Cleats and Ferrules.
19. Electric Kettles.
21. Electric Cookers.
22. Bare Hard Drawn High Conductivity Copper Conductors and P.V.C. Insulated Cables.
25. Overhead Line Equipment.

Forms of tender may be obtained from the Electricity Department, East Bridge Street, Belfast, 1, on payment of the sum of Ten Shillings (non-returnable) for each form. Extra copies of the forms may be obtained at Five Shillings each (non-returnable). Cheques should be made payable to the Belfast Corporation Electricity Department.

All letters, catalogues, drawings, etc., accompanying tenders must be submitted in duplicate.

Tenderers are advised that the Corporation Conditions of Contract only will apply. Any other conditions put forward by tenderers will not be accepted.

Tenders, in sealed envelope marked "Tender for Stores, Electricity Committee," and endorsed with the name and address of the firm tendering, must reach the undersigned not later than 4 p.m. on Friday, 19th January, 1962.

An official receipt must be obtained for each tender delivered by hand. Tenders sent by post should be registered.

The lowest or any tender will not necessarily be accepted.

JOHN DUNLOP,
Town Clerk.

City Hall, Belfast, 1.
P.O. Box 234.
12th December, 1961.

3311

BOROUGH OF WANSTEAD AND WOODFORD

District Roads (Stage VIII) and Hillside Avenue Lighting Schemes (Groups A and B)

TENDERS are invited for the installation of approximately 41 Group A Lighting Units and 344 Group B Lighting Units of various types in 77 roads in the Borough.

Tender documents may be obtained from the Borough Engineer, Municipal Offices, Woodford, London, E.18, on deposit of £5 and drawings may be inspected during office hours.

Tenders in envelopes provided by the Council to be delivered by noon on 15th January, 1962.

3312

CLASSIFIED ADVERTISEMENTS ARE PREPAID

BOROUGH OF DAGENHAM

Marks Gate County Junior School: Sub-Contracts for Electrical Installation (Form "A") and Heating Hot Water and Allied Services Installation (Form "B")

TENDERS for these sub-contracts must be returned to me by 31.1.62. Apply to the Borough Engineer and Surveyor for Form "A" or "B."

Only approved electrical contractors on the roll of the N.I.C.E.I.C. are eligible to tender for "A."

KEITH LAUDER,
Town Clerk.

Civic Centre,
Dagenham.

3316

SITUATIONS VACANT

(See "Replies to Box Numbers" on page 51)

CENTRAL ELECTRICITY GENERATING BOARD

Western Division

REACTOR ENGINEER

(ER/AV/125/61)

required at BERKELEY NUCLEAR POWER STATION, BERKELEY, GLOS.

Superannuation scheme. Salary N.J.B. Class M, Grade 6, Scale 15, £1,650 - £1,830 per annum. Good sick pay and holiday schemes in operation.

Applicants should preferably possess a university degree or equivalent qualification. Operational experience in a modern power station would be an advantage.

The successful candidate will be responsible to the Operation Superintendent for reactor fuel records, fuelling programmes, and for liaison with the Reactor Physicist on matters relating to reactor operation. An agile mind is required as the post offers many varied and interesting problems.

A course of theoretical and practical training of three to six months' duration will be given depending on the qualifications and experience of the successful candidate.

GENERAL ASSISTANT ENGINEERS

(ER/AV/126/61)

required at HINKLEY POINT NUCLEAR POWER STATION, BRIDGWATER, SOMERSET.

Superannuation scheme. Salary N.J.B. Class O, Grade 14, Scale 9, £1,115 - £1,245 per annum, plus 10% shift allowance. Good sick pay and holiday schemes are in operation.

Applications are invited for the above shift duty appointments on the permanent staff at the station.

The posts will provide opportunity for training, under senior engineers, in the operation of a large nuclear power station, including steam turbine and boiler plant, electrical control and nuclear reactors.

These posts will form a suitable basis for promotion to higher grades in the expanding field of nuclear power.

Previous power station or nuclear power experience is not essential. Possession of a Higher National Certificate in Mechanical or Electrical Engineering or similar qualifications would be an advantage.

ASSISTANT SHIFT CHARGE ENGINEER

(ER/AV/132/61)

required at PORTISHEAD "B" POWER STATION.

Superannuation scheme. Salary N.J.B. Class K, Grade 8, Scale 11, £1,275 - £1,410 per annum, plus 10% shift allowance. Good sick pay and holiday schemes are in operation.

Applicants should possess good technical qualifications and have had training and experience in the control and operation of modern steam generating plant and main switchgear.

FOURTH ASSISTANT ENGINEER

(ER/AV/129/61)

required in the MEASUREMENTS SECTION of the TRANSMISSION DEPARTMENT, WESTERN DIVISION, BRISTOL.

Superannuation scheme. Salary N.J.B. Class K, Grade 9, Scale 10, £1,050 - £1,325 per annum. Good sick pay and holiday schemes are in operation.

Candidates must have experience in testing precision power metering equipment including V.T.s and C.T.s, various types of summation equipment and instruments in the laboratory. A knowledge of electronic instruments desirable and site experience would be an advantage.

Applicants should preferably possess qualifications leading to Corporate Membership of the Institution of Electrical Engineers.

Applications for the above appointments on form A.E.6/ACT, obtainable from the Personnel Department, 26, Oakfield Road, Bristol, 8, should be completed and returned by 3rd January, 1962.

3295

FEDERAL GOVERNMENT OF NIGERIA

ELECTRICAL ENGINEER

(Meteorological Division)

QUALIFICATIONS: University Degree in Electrical Engineering or equivalent qualification. Experience of radio and radar equipment, preferably meteorological radio and radar aids, would be an advantage.

SALARY in the range £1,164 to £1,896 p.a. Gratuity of £150 p.a. is payable.

Write for application forms and further details, stating briefly age, qualifications and experience, to the Recruitment Attaché, Nigeria High Commission, 9, Northumberland Avenue, London, W.C.2, quoting reference P/C3311/3.

3291

SCOTTISH GAS BOARD

Westfield Works

Instrument Engineer

APPLICATIONS are invited from Engineers with appropriate qualifications and experience for the post of INSTRUMENT ENGINEER at the Lurgi Pressure Gasification Plant, Westfield, Fife.

The salary will be within the range £975 to £1,260 per annum, with initial placing according to qualifications and experience.

The Instrument Engineer will be responsible to the Works Engineer for the maintenance and satisfactory operation of all instruments on the works, including process-control and recording equipment.

The post is pensionable and the successful applicant will be required to pass a medical examination.

Applications, stating age and giving details of education, training, qualifications and experience, together with the names of two referees, should be sent to the undersigned within ten days of the appearance of this advertisement.

A. T. HERD,
Secretary.

26, Drumsheugh Gardens,
Edinburgh, 3.

3298

EAST MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited from suitably qualified and experienced persons for the following appointments. Applicants should state age, qualifications, experience, etc., and quote the appropriate vacancy number.

Northamptonshire Sub-Area

THIRD ASSISTANT ENGINEER (Control), SUB-AREA HEADQUARTERS (Vacancy No. 133/61).

Salary N.J.B. Class K, Grade 11, £1,040 to £1,165 per annum, plus shift allowance.

Candidates should have had experience of switching operations on a high-voltage distribution system, preferably including both urban and rural networks. Experience in the issue and cancellation of permits to work under the C.E. safety rules, or acting as control engineer for part of a high-voltage system, would be an advantage.

Applications should be addressed to the Manager, Northamptonshire Sub-Area, 25, Bridge Street, Northampton, by the 12th January, 1962.

Mansfield and North Nottinghamshire Sub-Area

THIRD ASSISTANT ENGINEER (Planning and Development), SUB-AREA HEADQUARTERS (Vacancy No. 134/61).

Salary N.J.B. Class L, Grade 11, £1,115 to £1,245 per annum.

The duties include assisting in the planning and preparation of schemes and specifications for the extension and reinforcement of overhead and underground distribution systems up to and including 11 kV, and the design and layout of substations.

Candidates should preferably hold the Higher National Certificate in Electrical Engineering or an equivalent qualification. Ability to drive a motor vehicle is desirable.

Applications should be forwarded to the Manager, Mansfield and North Nottinghamshire Sub-Area, Lime Tree Place, Mansfield, Notts., by the 12th January, 1962.

3297

NORTH EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments :—

Area Board Headquarters

SECOND ASSISTANT ENGINEER (System Protection), Chief Engineer's Department, Technical Section, with location at Carliol House, Newcastle upon Tyne. Applicants must be conversant with all aspects of work connected with system protection. Experience in the specification, application and installation of protective equipment in general, including fault flow calculations, is essential. Corporate membership of the I.E.E. an advantage.

Salary Class K, within grades 5/3, £1,415/£1,950 per annum. Conditions of service in accordance with National Joint Board Agreement for the Electricity Supply Industry.

Wear Sub-Area

SERVICE CENTRE SUPERVISOR with location at South Shields. Duties include the control of all the staff in the service centre, including demonstrators and cash clerks.

Salary Grade 5, i.e., £1,020/£1,140 per annum, according to qualifications and experience. Conditions of service in accordance with National Joint Council Agreement for the Electricity Supply Industry.

Applications stating age, qualifications and experience to be received by Assistant Secretary (Establishments), North Eastern Electricity Board, G.P.O. Box No. 117, Carliol House, Newcastle upon Tyne, 1, within fourteen days of the appearance of this advertisement.

3325

UPC

THE UNITED POWER COMPANY LTD.

formed to amalgamate the interests of Atomic Power Constructions Ltd. and the

GENERAL ELECTRIC-SIMON CARVES ATOMIC ENERGY CO. LTD.

has vacancies at ERITH for

ELECTRICAL ENGINEERS

to join the teams responsible for the contracts for Hunterston and Tokai-Mura Japan Nuclear Power Stations.

E.1. **GRADUATE ENGINEERS,** preferably with experience in power station distribution systems, required for the rating, specification and technical supervision of sub-contracts for power transformers, medium and H.V. switchgear.

E.2. **ENGINEERS** required for the detailed design of instrumentation and the associated control room of nuclear power stations. Experience of physical instrumentation at 50v relay control and alarm schemes a real advantage.

E.3. **AN ENGINEER,** familiar with the application of semi-conductor circuits to D.C. amplifiers, control schemes, data processing equipment or similar devices, required for the specification and technical supervision of sub-contractors.

E.4. **DRAUGHTSMEN** for layout of cable routes, scheduling and connecting up diagrams.

Write or phone, quoting reference, to:

Administration Manager, United Power Company, Birch Walk, Erith, Kent

Phone: Erith 33011 3287

SEB

Assistant Engineer (Planning)

Aldershot District of No. 3 (Portsmouth) Sub-Area. Salary N.J.B. Class H, Grade 9 (£1,040-£1,165 per annum). N.J.B. conditions of service.

The duties of the post will be to assist the Planning Engineer in the preparation of schemes and estimates for extensions of and reinforcement to overhead and underground H.V. and L.V. networks. Applicants should possess suitable technical qualifications.

Applications on forms obtainable from the Sub-Area Secretary, Southern Electricity Board, Lower Drayton Lane, Cosham, Portsmouth, and returned to him, quoting Z.1452, not later than 5th January, 1962.

Assistant Engineer (Maintenance and Operation)

Greenford District of No. 1 (Southall) Sub-Area. Salary N.J.B. Class H, Grade 10 (£1,015-£1,140 per annum, inclusive of London allowance). N.J.B. conditions of service.

The duties of the post will be to assist with the maintenance and operation of switchgear, transformers, cables and overhead lines up to and including 11 kV. The appointment will involve standby duties.

Applications on forms obtainable from the Sub-Area Secretary, Southern Electricity Board, 2/6, Windmill Lane, Southall, Middlesex, and returned to him, quoting Z.1434, not later than 5th January, 1962.

Assistant Engineer (Local)

Swindon District of No. 2 (Newbury) Sub-Area, located at Cirencester. Salary N.J.B. Class G, Grade 11 (£825-£940 per annum). N.J.B. conditions of service.

Applicants should have experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground distribution equipment, and possess suitable technical qualifications.

Applications on forms obtainable from the Sub-Area Secretary, Southern Electricity Board, 7, Oxford Road, Newbury, Berks., and returned to him, quoting Z.1457, not later than 5th January, 1962.

Installation Assistant

Weymouth District of No. 4 (Bournemouth) Sub-Area. Salary N.J.B. Class F, Grade 11 (£765-£870 per annum). N.J.B. conditions of service.

Applicants should have had experience in the preparation of specifications and estimates for all types of electrical wiring installations. They should be competent to supervise electricians and organise their work.

Applications on forms obtainable from the Sub-Area Secretary, Southern Electricity Board, 1, Priory Road, Bournemouth, Hants, and returned to him, quoting Z.1435, not later than 5th January, 1962.

The successful candidates for the above appointments will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible.

3296

TECHNICAL SALES ENGINEER

MAWDSLEY'S LIMITED
Dursley, Glos.

MAKERS of special-purpose rotating electrical machinery with wide and varied applications require technically qualified (Degree or H.N.C.) Sales Engineer to cover an area comprising East Midlands and East Anglia, preferably already living in Nottingham or Leicester.

Experience in design or manufacture of the company's type of product and related outside sales experience in the field are essential qualifications.

Salary will be negotiated. A pension and life assurance scheme is in operation.

Applications will be treated in ABSOLUTE CONFIDENCE and should be addressed to the Personnel Adviser, giving a full summary of career and training. 3288

Situations Vacant (*continued*)

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Region, North Thames Division

APPLICATIONS are invited for the following appointment at LITTLE BARFORD GENERATING STATION, ST. NEOTS, HUNTS.

GENERAL ASSISTANT ENGINEER
(S.V. No. 1569).

Salary N.J.B. Class J, within the range of Grades 17/15, Scales 1-3, £625 - £805 per annum, plus £90 per annum shift allowance whilst engaged on shift duties.

The commencing salary will depend upon the duties and responsibilities.

Duties of the above post include assisting in the electrical control room and experience in the technical operation of electrical, boiler house and turbine house plant, testing, etc., in a generating station, and provide a suitable basis for promotion to higher technical grades.

Manual workers in skilled grades with suitable technical training will be considered. Previous experience in a generating station and/or technical training to the standard of Ordinary National Certificate or its equivalent will be of advantage.

Housing accommodation may be available for the successful applicant.

Applications, quoting reference S.V. No. 1569, stating age, qualifications, previous experience and present position, should be sent to the Assistant Regional Personnel Officer, Central Electricity Generating Board, South Eastern Region, North Thames Division, West Farm Place, Chalk Lane, Cockfosters, Barnet, Herts., to arrive not later than the 6th January, 1962.

F. W. SKELCHER,
Assistant Regional Director.

3281

UNIVERSITY OF EXETER

APPLICATIONS are invited from suitably qualified persons for the post of MECHANICAL AND ELECTRICAL SERVICES CLERK OF WORKS for new Chemistry and Lecture Theatre buildings for the Universtiy of Exeter.

The successful candidate will be expected to take up his post as soon as possible and to work in collaboration with the Building Clerk of Works under the direction of the Architects and Consulting Engineers.

Salary not exceeding £1,200.

Applications, giving full details of qualifications and experience, should be sent to the Secretary, University of Exeter, Northcote House, The Queen's Drive, Exeter, by the 31st January, 1962.

3294

SWITCHGEAR SALES ENGINEER

AGE 25-35. H.N.C. in Electrical Engineering desirable. Good knowledge H.V. and L.V. switchgear could outweigh limited sales experience. Work covers sales correspondence, engineering of enquiries, estimating, tendering, handling of contracts—largely on own initiative and responsibility.

This vacancy created by expansion and offers prospects of advancement and assured future. Salary according to qualifications and experience.

Applications in writing in first instance to the Personnel Manager, J. G. Statter & Co. Ltd., Amersham, Bucks.

This is a company of the Metal Industries Group and the successful applicant will be required to join their group pension scheme.

3317

You'll find room to expand with 'ENGLISH ELECTRIC'

Stafford

TECHNICAL SALES ENGINEERS
Industrial Computer Applications

These vacancies have been created by the constant development and the increasing application, of Automatic Process Control within the Metal Industries Division.

The work entails the compilation of comprehensive tenders covering the complete range of equipment necessary for these schemes. Successful candidates, whilst being based at the Company's Main Works, Stafford, will be expected to travel in the U.K. or abroad. Such travel will involve short term assignments on site, investigating customers' installations, with a view to offering means of improving the quality and efficiency of production by the use of modern data processing and computer techniques.

Here is an exceptional opportunity for men with a degree or H.N.C. in Electrical Engineering to join a Company with an outstanding world-wide reputation. Excellent salaries are offered, according to qualifications and experience, and they are reviewed annually on a basis of individual merit. The Company also operates a first-class superannuation scheme.

Write now, quoting reference number ER1297U, to Mr. K. A. Hall, Sales Manager, M.I.D., at the address below.

DIELECTRICS

Physicists or Electrical Engineers are invited to join a new section engaged on research and development of electrical insulation. Emphasis is on the fundamental problems associated with the insulation of power equipment. As the Dielectrics Department forms part of the Nelson Engineering Laboratories, it is engaged on Company as well as Stafford Works problems.

Vacancies exist for men with a suitable degree or with H.N.C.; experience in dielectrics, though desirable, is not essential. Applicants, who should be between 21 and 35 years of age, are invited to write, quoting reference number ER1295T, to The Technical Staff Officer, at the address below.

Group Personnel Services,
English Electric House, Strand, London, W.C.2

'ENGLISH ELECTRIC'

3321

OPPORTUNITIES FOR ELECTRICAL ENGINEERS

THE BRITISH ALUMINIUM CO., LTD., invite applications from ELECTRICAL ENGINEERS for two vacancies, one in London where some travelling will be required, and one in Scotland. A degree is preferred, but provided there is evidence of suitable experience, a H.N.C. will be considered.

The preferred age range is 26 to 35, and candidates should have had a practical apprenticeship and training in heavy electrical engineering. Experience on construction, design or contract engineering an advantage. Salary will be according to qualifications and experience and there are generous pension and other benefits.

Apply in writing to **The Staff Manager, The British Aluminium Co. Ltd., Norfolk House, St. James's Square, LONDON, S.W.1.**

3324

CENTRAL ELECTRICITY GENERATING BOARD

South Western Region

Regional Electrical Department

Contracts Engineers

APPLICATIONS are invited from Electrical Engineers for posts as CONTRACTS ENGINEERS in the Regional Electrical Department, situated at Bradford House, St. Stephen's Avenue, Bristol, 1.

The successful applicants will be responsible for the general engineering of a group of high-voltage substation projects, including the preparation of technical enquiries and the assessment of tenders for 132-kV and lower-voltage switchgear, transformers, cables and overhead lines, as well as for the control, protection and metering equipments. Responsible experience in some of these branches of engineering and adaptability to the others are essential.

Corporate Membership of the Institution of Electrical Engineers would be an advantage.

The salary for the posts will be within the scales £1,415-£1,720 per annum and £1,320-£1,610 per annum.

Applications on form AE6/ACT, obtainable from the Regional Personnel Officer, Oakfield House, Oakfield Grove, Clifton, Bristol, 8, should be returned by the 5th January, 1961.

3306

CONSTRUCTORS JOHN BROWN LIMITED

have vacancies for

SUPERVISING ELECTRICAL ENGINEERS

APPLICANTS should have served a full apprenticeship with a reputable electrical contractor, possess a recognised technical qualification, and have experience of large industrial and flameproof installations from estimating to final account stage.

The successful candidates will be required to reside on sites in the U.K. and abroad for periods of from one to two years. Good salaries and allowances. Contributory pension scheme with life assurance benefits.

Please apply in writing, giving details of age, experience and qualifications, to:

Personnel Manager
CONSTRUCTORS JOHN BROWN LIMITED
CJB House, Eastbourne Terrace
Paddington, London, W.2
*quoting reference No. N*9054 334

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Region

Assistant Engineer, Nechells "A" & "B" Power Stations, West Midlands Division

APPLICATIONS are invited for the position of ASSISTANT ENGINEER at Nechells "A" and "B" Power Stations. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade K.12, £965-£1,090 per annum plus 10% shift allowance.

Applicants should have received a sound technical training and should preferably have had experience in the control of the works supply system. Appropriate technical qualifications will be an advantage.

Apply, quoting Vacancy No. 314/61 MR, on application form AE.6, available from the Station Superintendent, Nechells Power Station, off Aston Church Road, Nechells, Birmingham, 7, by 5th January, 1962.

3305

DEPUTY GENERAL MANAGER

(ADMINISTRATION)

required by the CENTRAL ELECTRICITY BOARD OF MAURITIUS on contract for 3 years to fashion and co-ordinate, at top management level, the administrative functions of several technical departments together with those in the accounting and secretarial fields.

The selected candidate will also be required to act as the Board's Secretary and Personnel Officer.

Salary equivalent to £2,250 a year. Housing and overseas allowance £360 a year. 4½ months' paid leave and gratuity of £960 on satisfactory completion of contract. Free first class passages.

Candidates must have had good experience in the administration of a similar organisation, and training and experience in accountancy. A secretarial/accountancy qualification; training in organisation and methods, internal auditing/management accounting techniques and a knowledge of punched card equipment desirable.

Apply to CROWN AGENTS, 4, Millbank, London, S.W.1, for application form and further particulars, stating age, name, brief details of qualifications and experience, and quoting reference M3B/53687/EF.

3290

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Region, North Thames Division

APPLICATIONS are invited for the following appointments:—

ASSISTANT SHIFT CHARGE ENGINEER, LITTLE BARFORD GENERATING STATION
(St. Neots, Hunts)
(S.V. No. 1573).

Salary N.J.B. Class J. Grade 8, Scale 10, £1,190 - £1,325 per annum, plus 10% shift allowance.

Applicants should have served an apprenticeship and obtained a Higher National Certificate in Electrical or Mechanical Engineering, or equivalent qualification. Preference will be given to applicants who have had experience in the operation of large modern units utilising pulverised fuel.

Housing accommodation may be available for the successful applicant.

Applications, quoting Reference No. S.V.1573, stating age, qualifications, experience and present position, should be sent to the Assistant Regional Personnel Officer, Central Electricity Generating Board, North Thames Division, West Farm Place, Chalk Lane, Cockfosters, Barnet, Herts., to arrive not later than 5th January, 1962.

F. W. SKELCHER,
Assistant Regional Director.

3326

BRITISH ENGINE BOILER & ELECTRICAL INSURANCE CO. LTD.

Longridge House, Manchester, 4

ELECTRICAL SURVEYORS required. Permanent positions carrying progressive salary scale £825 to £1,225 with non-contributory pension. Candidates, aged 26 to 32, with H.N.C. in Electrical Engineering or Grad. I.E.E., and with apprenticeship in manufacture or repair of electrical machinery, are invited to apply stating age, qualifications and experience.

3307

SOUTH WALES ELECTRICITY BOARD

Demonstrators

APPLICATIONS are invited for the following posts in the Swansea and West Central Area:—

(a) DEMONSTRATOR, PORT TALBOT DISTRICT.
(b) DEMONSTRATOR, NEATH DISTRICT.

Salary N.J.C. Grade 1, £600/£700 per annum.

Candidates must be competent to give demonstrations and lectures in public halls, consumers' houses or showrooms on cooking, laundering or housecraft subjects. They should also have sales ability for showroom duties and a good knowledge of electrical appliances. The qualifications required are the diploma of a recognised domestic science college or the Demonstrators' Certificate, and candidates should hold the E.A.W. Certificate.

The persons appointed will be required to take part in agreed rotas of Saturday working.

Applications stating age, present position, qualifications and experience should be addressed to the undersigned at St. Mellons, Cardiff, to arrive not later than 20th January, 1962. Envelopes should be endorsed "Demonstrators 152/61."

R. G. WILLIAMS,
Secretary.

3292

ELECTRICAL DRAUGHTSMAN

(Male or Female)

required by UGANDA GOVERNMENT Ministry of Works on contract for one tour of 21-27 months in first instance. Salary according to age and experience in scale (including overseas addition) rising to £1,671 a year. Gratuity 25% of total salary drawn. Outfit allowance £30. Free passages. Liberal leave on full salary. Quarters provided, when available, at moderate rental, or hotel allowance.

Candidates, 26-45 years of age, must have served a two years' apprenticeship with firm of electrical consultants (or other approved training). They must also have at least five years' approved experience as Electrical Draughtsman/Draughtswoman. Possession of Higher National Diploma or Certificate in Electrical Engineering an advantage. Female candidate must be single.

Apply to CROWN AGENTS, 4, Millbank, London, S.W.1, for application form and further particulars, stating age, name, brief details of qualifications and experience, and quoting reference M2/51352/EF.

3289

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

No. 4 Sub-Area

ASSISTANT SECTION ENGINEER required at Machynlleth. Salary within the range £825/£940 per annum (N.J.B. E.9, Scale 5).

Applicants should preferably have had experience in the construction, operation and maintenance of overhead and underground high and medium-voltage networks with their associated substations and equipment.

Appointment subject to medical examination. Pension scheme.

Application forms obtainable from the Manager, No. 4 Sub-Area, Electricity House, Rhostyllen, near Wrexham.

Closing date 8th January, 1961.

PREVIOUS APPLICANTS NEED NOT RE-APPLY. 3310

Situations Vacant (continued)

SOUTH WALES ELECTRICITY BOARD

District Commercial Engineer

APPLICATIONS are invited for the position of DISTRICT COMMERCIAL ENGINEER in the Neath District of the Swansea and West Central Area.

Salary N.J.B. Class F, Grade 3, Scale 12, £1,350/£1,500 per annum.

Applicants should possess a suitable professional qualification.

The successful applicant will be responsible to the District Manager for the organisation and supervision of all commercial activities within the District. He should have experience in advising consumers on the utilisation of electricity, in the management of showrooms and the supervision of a contracting department.

The District which is mainly industrial in character also has urban and rural areas.

Applications stating age, qualifications, experience, etc., should be addressed to G. R. T. Edwards, B.Sc., M.I.E.E., M.Am.I.E.E., Manager, Swansea and West Central Area, 29, Ystrad Road, Swansea Industrial Estate, Swansea, to reach him by 13th January, 1962.

Please quote reference 150/61/ER, endorsing envelope "District Commercial Engineer."

R. G. WILLIAMS,
Secretary.
3293

GENERAL MANAGER MAURITIUS CENTRAL ELECTRICITY BOARD

APPLICATIONS are invited for appointment on contract for 3 years in the first instance. Post gives sole responsibility, under the Board, for management, operation and continuing development of the undertaking.

Salary £2,700 a year plus housing and overseas allowance £750 a year. 4½ months' paid leave and gratuity of £960 on satisfactory completion of contract. Free first class passages officer, wife and children under 18.

Candidates, preferably under 50 years of age, must have had wide experience in all fields of public electricity supply, generation, transmission and distribution, accountancy and commercial. A general knowledge of civil and mechanical engineering an advantage.

Apply to CROWN AGENTS, 4, Millbank, London, S.W.1, for application form and further particulars, stating age, name, brief details of qualifications and experience, and quoting reference M2/51515/EF.
3308

A LARGE company of electrical engineers and contractors have a vacancy for a supervising engineer at their head office in Westminster. A bonus scheme is in operation, also a non-contributory pension scheme for those under the age of fifty years when joining the staff. Engineers with qualifications to enable them to undertake the supervision of the largest contracts are requested to apply, stating details of experience, age and present salary, to—Box 3282.

CONSULTING engineers require electrical engineer with experience and competent to supervise erection and setting to work of high-voltage switching and transforming stations; with knowledge of protective gear and associated equipment. Candidates should preferably have Degree or H.N.C. Applications to—Kennedy & Donkin (Ref. HHJ), 12, Caxton Street, London, S.W.1. 3318

CONSULTING engineer requires H.N.C. level supporting staff for senior electrical engineers engaged on design of installation work in large and interesting commercial and industrial projects. Applicants should state age, experience, qualifications and salary required.—G. H. Buckle & Partners, 2, Harrington Gardens, London, S.W.7. 3299

CONTRACTORS' engineer and also an assistant required by leading and busy firm Central London. Experience essential in all classes of installation work. Qualities of initiative, industry, enthusiasm and ambition would be amply rewarded. Write, in confidence, age, experience, qualifications and present salary.—Box 140.

ELECTRICAL and mechanical maintenance fitter required for repairs and overhaul of equipment in canteens/schools in the Mid-Essex Division. Applicants must have served an apprenticeship in the electrical contracting industry and have had experience of all types of electrical installations and maintenance of equipment. Experience in maintenance of refrigerators will be an advantage. Salary and conditions of service in accordance with Grade V of the N.J.C. Miscellaneous Classes of Officers. 42-hour week, salary range £685/£760 per annum. A service van will be provided. Application forms, which must be returned as soon as possible, may be obtained by sending a stamped addressed envelope to the Divisional Education Officer, Springfield Dukes, Springfield Green, Chelmsford. 3300

ELECTRICAL engineer required by insurance company for inspection of plant, etc. Must have H.N.C. in Electrical Engineering or equivalent. Must be prepared to be away from home for periods. Suitable bachelor. Permanent area later. Interesting work. Starting salary £825 p.a. rising to £1,225 p.a. (E.S.A. scale). Other benefits. Allowance paid when away from home. Write—Box ER.967, L.P.E., 60/62, St. Martin's Lane, London, W.C.2. 3322

ELECTRICAL engineer surveyors capable of working on own initiative from home are required by the Northern & Employers' Group for all types of electrical plant. Vacancies exist in the Bristol, Birmingham and Leeds districts. Applicants should hold Higher National Certificate, have served an apprenticeship and have had wide subsequent experience. Progressive salary scale £825 rising to £1,225 plus expenses and allowances. Car provided. Non-contributory pension scheme and other staff schemes. Applicants should write giving full details and stating area preferred to the Joint General Managers, The Northern & Employers' Group. 1, Moorgate, London, E.C.2. 3319

ELECTRICIANS very urgently required. London rates. Contract work.—Leonard J. Ive Ltd., 29, Clarendon Road, Watford (Telephone 29626). 3259

ENGINEER, about 25 years of age, Higher National Certificate minimum requirement, for work in development and production of coils for the electrical industry. Apply to Southern Trade Services Ltd., 138, Southbridge Road, Croydon, Surrey. 3301

EXPERIENCED representatives, with contracting and user connections in South London, are required by a rapidly expanding electrical wholesaler. Successful applicants will be chosen by the 12th of February, 1962. Write in confidence giving age, education and experience to—Box ER.7660, c/o Whites, 72, Fleet Street, London, E.C.4. 219

SENIOR contract engineer required for Newcastle office of national electrical contractors. Must be experienced in estimating, supervision of labour and invoicing of major contracts. Apply in confidence, giving full details of experience, salary required, etc., to—Box 3302.

SENIOR contracts engineer required by large Manchester electrical contractor. Age group 35 - 45, with minimum qualifications H.N.C., sound practical training in heavy industrial contracts and wide experience in all forms of electrical installation work. Applicants should have proved experience of contract managements, estimating and labour control. Excellent prospects for man of energy, courage and initiative. Please apply in writing giving full details including salary expected, to—Box 3221.

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

SITUATIONS WANTED

A.M.I.E.E. (47), at present general manager with small firm, seeks new post. Formerly with both medium and very large firms in managerial capacity. Medium and light engineering (not electronics as yet), covering design and sales in wide aspects of heating, lighting, control panels, site supervision, etc. References will confirm loyalty, balanced judgment, hard worker and value generally. Resident London. Min. starting salary £1,500.—Box 8414.

SALES executive, with first-class live connection amongst wholesalers and retailers in the electrical and radio trade in the West of England and Wales, including supervision of Bristol depot, seeks new position. Excellent sales record, top contacts, able administrator.—Box 8409.

ARTICLES FOR SALE

UNUSED ALTERNATORS FOR SALE

Frustrated Exports

	kW	r.p.m.		
One	130	600/720	3ph./50/60cy.	380 v.
Two	132	720	3ph./60 cy.	380 v.
One	346	600	3ph./50 cy.	415 v.
One	310	750	do.	do.
Four	110	600	do.	400/440v.
Three	225	600	do.	3.3/6.6kV
Three	620	750	do.	3.3 kV

All single-bearing machines for direct coupling. Makers' guarantee. Very low prices.

FYFE, WILSON & CO. LTD., Engineers
Bishop's Stortford, Herts
(B.S. 1000/1/2)
162

HOUSE SERVICE METERS

200 200-240-v. A.C. or D.C., 10 amps. capacity, quarterly type, from 25s. each, plus 2s. 6d. carr.

UNIVERSAL ELECTRICAL CO.
221, City Road, London, E.C.1 37

A.A. ELECTRICAL Co. for A.C. - D.C. motors, switchgear, exhaust fans, hoists, reduction gears, new or reconditioned units.—CHI. 5105. 67, Rothschild Rd. London W.4. 57

A.C. and D.C. motors, generators, from stock.—Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. (Edgware 5566/9). 91

A.C. and D.C. slotmeters and quarterlies. Reconditioned, guaranteed 2 years. Repairs and recalibrations.—Victor Electric Co., South View, Sweet Hill, Patcham, Brighton, Sussex. 205

ALTERNATORS, 3-phase, all sizes in stock from 7 kVA up to 600 kVA.—Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1 (CLErkenwell 5512). 24

ALTERNATORS and generators, all types up to 150 kW.—Powerco Ltd., 312, York Road, London, S.W.18 (VAN. 5234). 151

BARGAINS in electric motors from A. Cooksley & Co. Ltd., 21/25, Tabernacle Street, London, E.C.2. Ring Monarch 3355. 50

BRASS lampholders. Standard ½" B.C.s.c. and ¼" pushbar. Competitive prices. Largest stockists in London.—N.L.C., 40, Manchester St., London W.1 (WELbeck 3300). 3199

CABLE, armoured, P.I.L.C., P.V.C., R.I.L.C., V.C.I.L.C. All sizes in stock at our London works. Cutting and delivery same day as order received. Priced stock lists.—Batt Electrical Co., 6, Dock St., London, E.1 (Tel. Royal 5905). 316

CIRCUIT-breakers, various sizes in stock, A.C. and D.C., 200 amperes up to 2,000 amperes. Also dynamo and alternator switchboards. — Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 26

CONVERTERS, motor-alternators, motor-generators, frequency changers, etc. All types up to 100 kW.—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 150

CRANE motors. Direct current, series wound or compound wound, all voltages. We have large stocks.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 22

DIESEL generating sets, all sizes to 500 kW. Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 16

ELECTRIC motors, dynamos, alternators and motor generator sets of all sizes. We hold one of the largest stocks in England. New and reconditioned, with 12 months' guarantee.—Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1 (Clerkenwell 5512, 3 lines); also Works and Stores, Chobham, Surrey. 20

ELECTRIC motors, generators, motor generator sets, transformers, switchgear, etc., large comprehensive stock, overhauled and guaranteed. Copy of our Register, "Electrical Surplus," containing thousands of items of electrical plant, sent on request.—R. F. Winder Ltd., Belgrave Electrical Works, Leeds, 2. 54

FLUORESCENT tubes reconditioned and guaranteed with a life as new for 7s. 6d. each. Free collection and delivery in Lancs and Yorks. We are also manufacturers of top quality fluorescent fittings, trunking systems, control gear and new fluorescent tubes. Generous discounts available.—Anglo-American Electrical Company, Olive Street, Bury (Telephone, Bolton 27251). 212

FOR sale, good unused and used machinery including electric motors, A.C. and D.C. dynamos, alternators, transformers, diesel and steam electric generating sets, mains failure sets, motor generator and Ward Leonard sets, switchgear, compressors, fans, capacitors, etc.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford, Herts (Tel. B.S. 1000/1). 161

GEARED motorised units. If the call is urgent within the fractional range, phone CLE. 4141.—Jeary Electrical, 132, East Road, London, N.1. 127

GENERATING sets, portable or stationary, new and reconditioned, 1 to 100 kW, A.C. and D.C. — Powerco Ltd., 312, York Road, London, S.W.18 (VAN. 5234). 148

INSULATING varnish, clear, Minerva No. 720, £10 per 40-gal. drum.—Lowton Metals Ltd., Sandy Lane, Lowton St. Mary's, Leigh, Lancs. (Tel. 71441/2). 93

KARDEX, Roneodex and Shannovue cabinets, as new.—F. H. Jolly & Co. Ltd., 289, King St., London, W.6 (RIV. 5381). 202

MOTOR generator sets and converters, all sizes and voltages from ½ kW up to 500 kW in stock.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, City Road, London, N.1 (Tel. Clerkenwell 5512, 5513 & 5514). 12

MOTORS and control gear, huge stocks all types, ¼ to 200 h.p.—Ramsbottom & Co. Ltd., Elec. Engineers, Keighley (5444/7). 70

NAMEPLATES, engraving, diesinking, stencils. — Stilwell & Sons Ltd., 153, Far Gosford Street, Coventry. 108

PHASE converters, single to three-phase, several sizes in stock up to 90 h.p., 3-phase loading. — Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 29

PLATING dynamos and motor generator sets, various sizes from 500 amps. up to 2,000 amps., with A.C. and D.C. motors.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 15

POLYPHASE kilowatt hour meters. Available from stock.—Universal Electrical, 221, City Road, London, E.C.1. 40

PREPAYMENT 1s. slot house service meters. —Universal Electrical, 217-221, City Road, London, E.C.1. 36

PURLEY chokes and ballasts. Our 80-w. tapped h.p.f. ballast with starter switchholder incorporated is proving itself the most popular unit. Suitable for most fittings, 57s. 6d. each subject.—F. W. Blanshard Ltd. (Dept. ER), Purley, Surrey (Uplands 4818/9). 52

ROTARY converters in stock, all sizes; enquiries invited. — Universal Electrical, 221, City Road, London, E.C.1. 34

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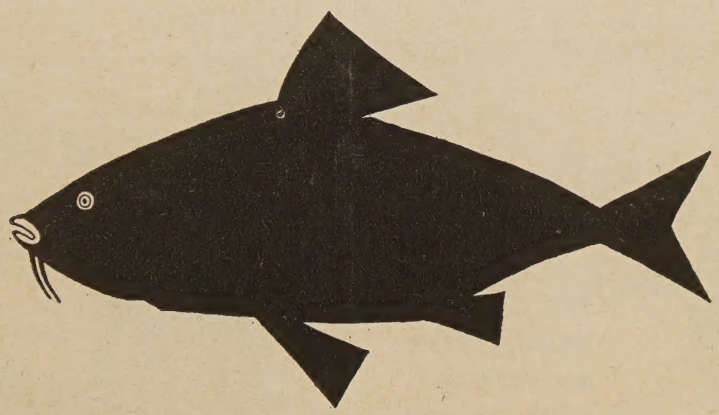
Carp—sign of Tufnol



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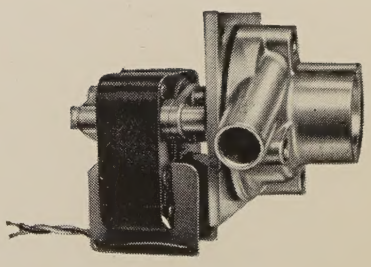

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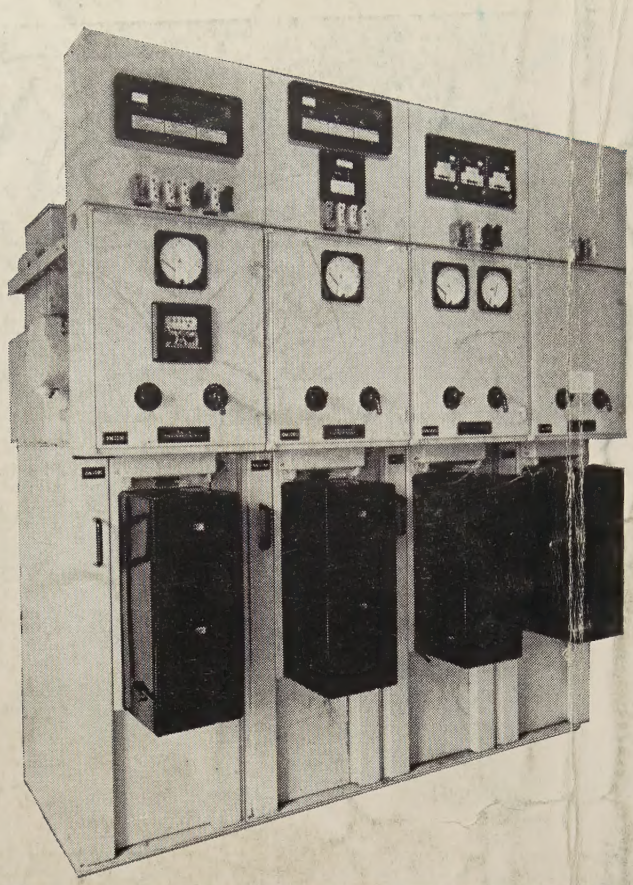

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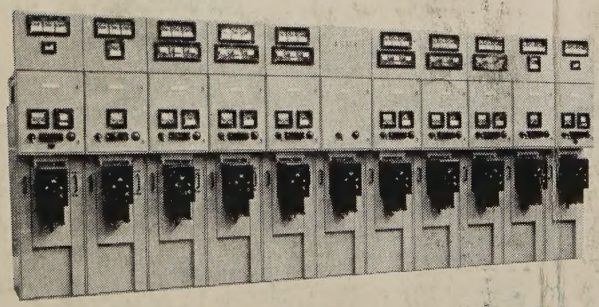

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